NR KPP Development Tutorial

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Bottom Line Up Front

Achieving interoperability within the DoD requires more than building DoDAF architecture products for the NR-KPP. Interoperability has inherent operational and system technical requirements that must be met in order to provide the desired warfighting capability.

Outline

- Overview
- Background
- Interoperability Requirements
- JCAS Examples
  - Link-16
  - Chat
- Summary

NR KPP Refinement

- Current Net Ready Key Performance Parameter (NR KPP)
  - Too Broad
  - Not Measurable or Testable
  - Ambiguous, contains “compliance areas” (homework checking)
  - No longer answers the “So What” for certification or provide the operational impact if not interoperable
- NR KPP Refined
  - NR KPP refined by synchronizing all the ASD/NII, AT&L, MCEB, NC FCB, RDA CHSENG, DISA OAS/DNII, DISA JITC, JFCOM and Services efforts thru a year long working group
  - Refined NR KPP: maps back to military operations
    - ATTRIBUTES : Support Military Operations; Enter And Be Managed in the Network; Exchange Information
    - MEASURABLE/TESTABLE: User/PM Developed MOE and MOP; Objective and Threshold Values.
    - VALIDATED BY ARCHITECTURE
  - CJCSI 6212.01F
    - Reviewed by 31 organizations (AO, O-6, FOGO) that concur, adjudicated 72 critical comments.
    - Refined down to the NR KPP (128 pages down to 61 pages) to what JCIDS requires, Integrators, Assessors, Users, PMs, Reviewers have to do.
    - NR KPP “Online” Manual created (Tell Integrators, Assessors, Users, PMs, Reviewers how to do it)

NR KPP REFINED FROM OLD NR KPP TO USER/PM DEVELOPED MEASURABLE/TESTABLE NR KPP KPP

OLD NR KPP
- BASED ON 5 "COMPLIANCE AREAS"
- NOT MEASURABLE/TESTABLE

REFINED NR KPP
- ATTRIBUTES
- MEASURABLE/TESTABLE
- VALIDATED BY ARCHITECTURE

KPP	Threshold (T)	Objective (O)
The capability, system, and/or service must - Support Net-Centric military operations - Enter and be managed in the network - Exchange Information	Effectiveness Measures Performance Measures	Effectiveness Measures Performance Measures

REFINED NR KPP EXAMPLE

KPP	Threshold (T)	Objective (O)
Net-Ready: The capability, system, and/or service must support Net-Centric military	The capability, system, and/or service must fully support execution in the DOD Enterprise Architecture and solution architectures based on integrated DODAF content, and must satisfy the technical requirements for transition to Net-Centric military	The capability, system, and/or service must fully support exchanges identified in DOD Enterprise Architecture and solution architectures based on integrated DODAF content, and

NR-KPP Performance and Effectiveness

Description

COMPLIANCE AREAS - REMOVE

ATTRIBUTES

MEASURABLE TESTABLE KPP

REFINED NR KPP ATTRIBUTES:
- **SPT MIL OPS (MAPS TO CAPABILITY)**
- **ENTER/MANAGED IN NET**
- **EXCHANGE INFORMATION**

NR KPP Attribute	Key Performance Parameter	Threshold	Objective
Support to military operations	Mission: Tracking and locating (Finding, Fixing, Finishing) High-Value Target (HVT) Measure: Timely, actionable dissemination of acquisition data for HVT Conditions: Targeting quality data to the neutralizing/tracking entity	10 minutes Area denial of HVT activities	Near-real-time HVT tracked, neutralized
	Mission Activities: Find HVT Measure: Location accuracy Conditions: Individual differentiation	100 meter circle Identify armed/not armed	25 meter circle Identify individual
Enter and be managed in the network	Network: SIPRNET Measure: Time to connect to an operational network from power up Conditions: Network connectivity	2 minutes 99.8	1 minute 99.9
	Network: NIPRNET Measure: Time to connect to an operational network from power up Conditions: Network connectivity	2 minutes 99.8	1 minute 99.9
Exchange information	Information Element: Target Data Measure: Dissemination of HVT biographic and physical data Measure: Receipt of HVT data Measure: Latency of data Measure: Strength of encryption	10 seconds Line of Sight (LOS) 5 seconds NSA certified	5 seconds Beyond LOS 2 seconds NSA certified type 1

Three Attributes of the NR-KPP Description

NR-KPP Description	Attribute	Metrics	Used For	Data Sources
Support net-centric military operations	Military Operations (e.g. mission areas or mission threads)	Effectiveness Measures used to determine success of the military operation	NR-KPP Effectiveness Measures	JMETLs and NMETLs
		Conditions under which the military operations must be executed		
	Operational tasks required by the military operations	Operational Performance Measures used to determine activity performance	NR-KPP Performance Measures	JMETLs and NMETLs
		Conditions under which the activity must be performed		
Enter and be managed in the network	Which networks do the net-centric military operations require	Operational Performance Measures for entering the network	NR-KPP Performance Measures	N/A
		Operational Performance Measures for being managed in the network		
Exchange Information	Information produced and consumed by each military operation and operational task	Operational Performance measures to ensure exchanges are: Continuous Survivable Interoperable Secure Operationally Effective	NR-KPP Performance Measures	DoDAF OV-3 Operational Information Exchange Matrix

NR KPP Example

NR KPP Attribute	Key Performance Parameter	Threshold	Objective
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Exchange information	Information Element: Target Data Measure: Dissemination of HVT biographic and physical data Measure: Receipt of HVT data Measure: Latency of data Measure: Strength of encryption Conditions: Tactical/Geopolitical	10 seconds Line of Sight (LOS) 5 seconds NSA certified type 1 Permissive environment	5 seconds Beyond LOS 2 seconds NSA certified type 1 Non-permissive environment

Supporting NR KPP Architecture DATA – Yikes!

Document/ Architecture	AV-1	AV-2	CV-1	CV-2	CV-3	CV-4	CV-5	CV-6	DIV-1	DIV-2 (OV-7)	DIV-3 (SV-11)	OV-1	OV-2	OV-3	OV-4	OV-5a	OV-5b	OV-6a	OV-6c	PV-2	SV-1 or SvcV-1	SV-2 or SvcV-2	SV-4 or SvcV-4	SV-5a or SvcV-5	SV-6 or SvcV-6	SV-7 or SVcV-7[6]	SvcV-10a	SvcV-10b	SvcV-10c	StdV-1 (TV-1)	StdV-2 (TV-2)
DCR	1		R	R	R	R						R														R					
CONOPS	1		R	R	R	R		R				R	R		R	R										R					
ICD	1	X	R	R	R	R		R				X	X		X	X	O									R					
CDD	1	X	X	X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X	X	X				X^2	X^2
CPD	1	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X				X^2	X^2
IC[3, 4]	X	X	X	X			X		X	X		X	X	X		X	X	X	X		X	X	X	X	X		X	X	X	X	X
Legend		X – Required O – Optional R- Recommended, PM needs to check with their Component for any additional architectural/regulatory requirements for CDDs, CPDs. (e.g., HQDA requires the SV-10c, USMC requires the SV-3, IC requires the SvcV-10a and SvcV-8)																													
Note 1		The AV-1 must be registered, must be "public" and "released" at the lowest classification level possible in DARS for compliance.																													
Note 2		The technical portion of the StdV-1 and StdV-2 are built using GTG-F DISR standards profiling resources and, within six months of submitting JCIDS documentation, must be current and published for compliance. Use of non-mandated DISR standards in the StdV-1 must be approved by the PM or other duly designated Component cognizant official and documented by a waiver notification provided to the DoD CIO."																													
Note 3		Intelligence Community (IC) requirements IAW the IC Enterprise Architecture Program Architecture Guide and development phase which clarifies the IC Policy Guidance 801.1 Acquisition.																													
Note 4		Service Views (SvcV) only																													
Note 5		1. The Sponsor* and the Program are jointly responsible for the AV-1, AV-2, CV-1, CV-2, CV-3, CV-4, CV-5, CV6, SV-6 or SvcV-7. 2. The Sponsor* is responsible for the development of the architecture data for the OV-1, OV-2, OV-4, OV-5a, OV6c, DIV-2, and the SV-6 or SvcV-6. 3. The Program is responsible for the development of the architecture data for the DIV-1, DIV-3, OV-3, OV-5b, OV-6a, PV-2, SV-1 or SvcV-1, SV-2 or SvcV-2, SV-4 or SvcV-4, SV-5a or SvcV-5, SvcV-10a, SvcV-10b, SvcV-10c, StdV-1, and StdV-2. * Operational user (or representative).																													
Note 6		The NR-KPP Measures data is captured in the SV-7 or the SvcV-7.																													

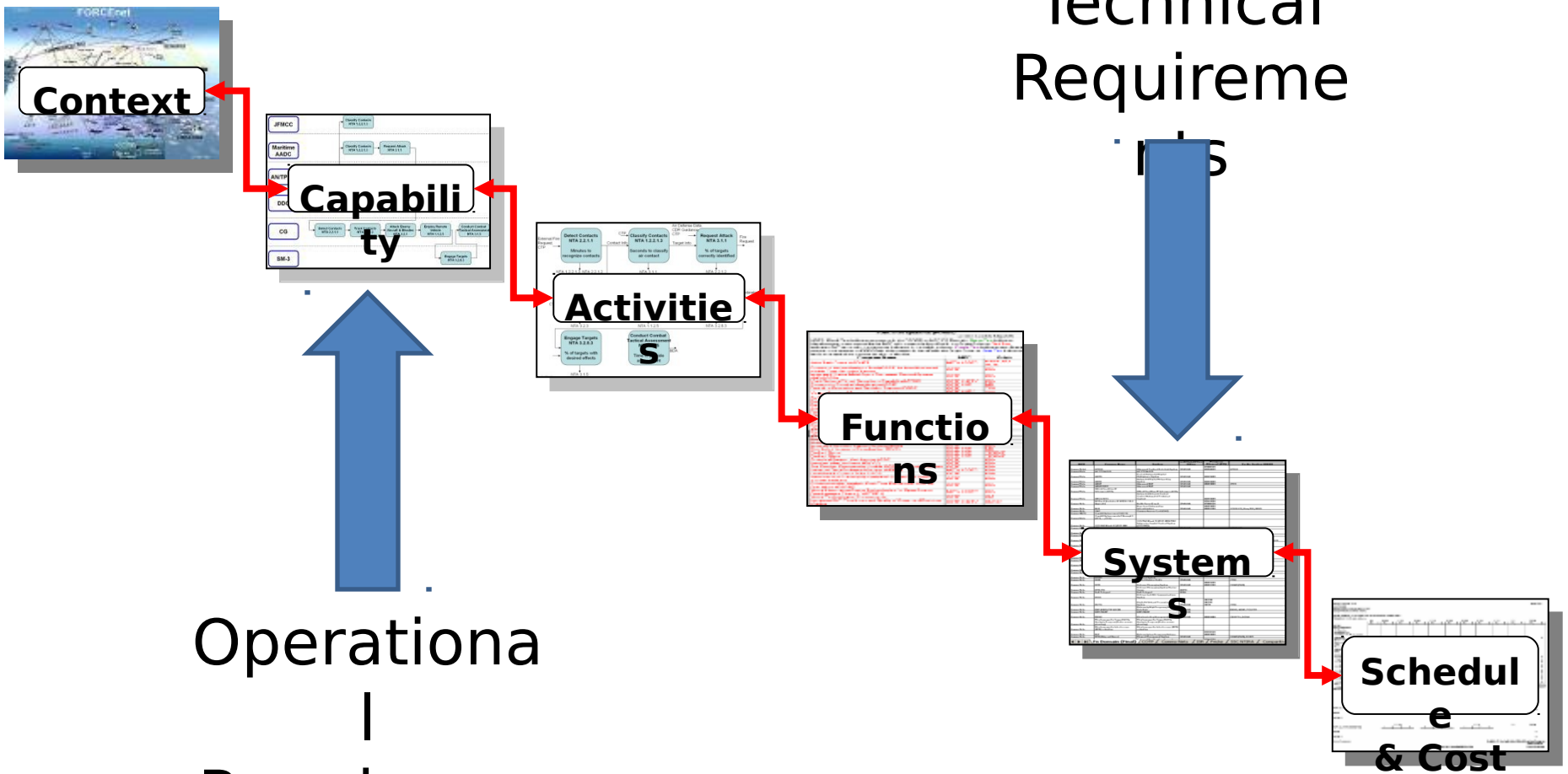
Purpose

- Describe a process for developing and documenting interoperability requirements
  - Use Link-16 and Chat as examples
  - The process is based on the Assistant Secretary of the Navy (Research, Development, and Acquisition) Chief Systems Engineer's (ASN (RDA) CHSENG's) NR-KPP Guidebook.
  - The presentation will also describe how this guidance implements the JCIDS process.

Key Themes

- Interoperability requires more than just developing DoDAF architecture products
- Interoperability has operational relevance
  - Otherwise programs could just list System Data Exchanges in an SV-6 and be done with it
- Systems Engineering principles can be applied to Interoperability
- The ideas in the brief need to be tailored for what is applicable to a particular program/capability

Interoperability Requirements Must Link Operational and Technical Requirements



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Some Confusing Terms

Interoperability

Net-Readiness

Net-Centric

NR-KPP

How Do They Relate? What Do They Mean?

Interoperability

From Joint Publication 1-02…

Interoperability is:

1. The ability to operate in synergy in the ***execution of assigned tasks***. Source: JP 3-0

2. The condition achieved among communications-electronics systems or items of communications-electronics equipment when ***information or services can be exchanged directly and satisfactorily*** between them and/or their users. The degree of interoperability should be defined when referring to specific cases. Source: JP 6-0

erability Is More Than Passing Information Between S

Net-Readiness

Summarized from CJCSI 6212.01E…

A Net-Ready system:

Meets the requirements for both the ***technical exchange*** of information and the ***operational effectiveness*** of those exchanges. These requirements include information needs, information timeliness, IA accreditation, and Net-ready attributes.

diness Adds More Detail To The Definition of Interope

NR-KPP

Summarized from CJCSI 6212.01E…

The NR-KPP:

Is a key parameter stating a system's operational requirements for information, the timeliness of that information, Information Assurance (IA), and net-ready attributes for both the ***technical exchange*** of information and the ***operational effectiveness*** of that exchange.

The NR-KPP Is Meant To Ensure Systems Are Net-Read

Net-Centric

- There is no official definition for Net-Centric
  - It is defined in the Joint Capability Areas (JCAs) and DoDI 8000.01 but the definitions are different
  - It is defined when used with other terms (e.g. Net-Centric Military Operations, Net-Centric Environment)

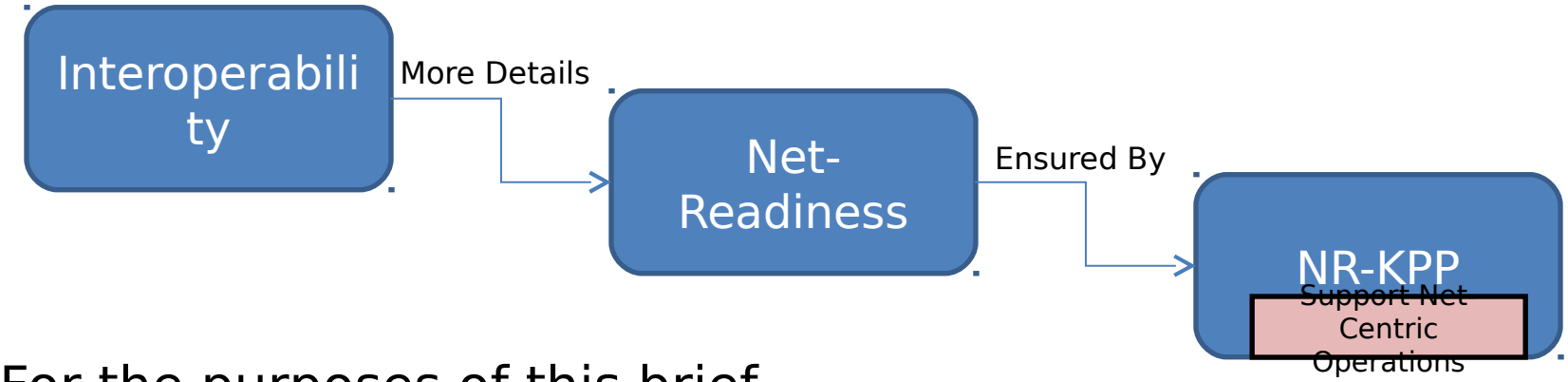
- Adapted from the Net-Centric Environment JFC…

Net-Centric Military Operations are:

The military exploitation of the human and technical networking of all elements of an appropriately trained joint force by fully integrating collective capabilities, awareness, knowledge, experience, and superior decision making to achieve a high level of agility and ***effectiveness*** in dispersed, decentralized, dynamic and uncertain military operational environments.

rting Net-Centric Military Operations Is Part Of The N

Unconfusing The Terms



For the purposes of this brief

- Interoperability is the operational requirement we must meet
- Net-Readiness provides the details of what an interoperable system must do
- The NR-KPP ensures Net-Readiness and therefore provides performance parameters that ensure interoperability
- Supporting Net-Centric Military Operations is a requirement of the NR-KPP

tional Effectiveness Is A Key Theme Throughout The

Ok. Now What?

- This workshop did not just turn into an NR-KPP workshop
  - The instruction describing the NR-KPP is currently under revision (CJCSI 6212.01F)
- However… We will assume
  - The current NR-KPP gives us necessary and sufficient performance parameters for our interoperability requirements
  - These performance parameters are inherent to interoperability and must be specified regardless of changes to DoD instructions
- We will also see how to satisfy the Threshold and Objective requirements of the NR-KPP

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Our Interoperability Requirements (Finally)

"The capability, system, and/or service must support Net-Centric military operations. The capability, system, and/or service must be able to enter and be managed in the network, and exchange data in a secure manner to enhance mission effectiveness. The capability, system, and/or service must continuously provide survivable, interoperable, secure, and operationally effective information exchanges to enable a Net-Centric military capability."

- CJCSI 6212.01E

- We will assume interoperability has 4 requirements
  - Support Net-Centric Military Operations
  - Enter and Be Managed in the Network
  - Exchange Information
  - Satisfy Technical Requirements implied by the other requirements

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Support Net-Centric Military Operations

- Net-Ready Missions
  - Missions that require producing information for or consuming information from an external system
  - Operational Effectiveness Measures describing mission success
  - Example: Joint Close Air Support (JCAS) mission with an effectiveness measure of time to put weapons on target
- Net-Ready Operational Tasks
  - Operational activities within the missions that require producing information for or consuming information from an external system
  - Operational Performance Measures describing successful task performance
    - Successful means that task performance results in required mission performance
  - Example: Launch weapon operational task in JCAS with an effectiveness measure of weapon accuracy

res Are Critical For Meeting The Effectiveness Requir

Enter and Be Managed In The Network

- Networks the system must connect to
  - IP Networks (e.g. NIPR, SIPR)
  - Non-IP Networks (e.g. Link-16, Voice)
  - Application Networks (e.g. Chat, GCCS-J)
- Performance measures that will be used to measure successful network connection
  - Examples: Time to connect? Bandwidth of connection? Etc.?
- How the system's network connection will be managed
  - Examples: Who manages? Where is management? Network configuration parameters?

res Are Critical For Meeting The Effectiveness Requir

Exchange Information

- Information needed to successfully accomplish all Net-Ready Operational Tasks
  - Example: Target information in JCAS is needed to launch the weapon
- Information produced by any Net-Ready Operational Task that must be sent to another system
  - Example: Launching the weapon in JCAS will produce battle damage assessment
- Operational Performance Measures describing successful exchange of information
  - Successful means that performance of the exchange results in required operational task performance
  - Examples: Timeliness? Continuity? Survivability? Security? Unanticipated users?

res Are Critical For Meeting The Effectiveness Requir

Satisfy Implied Technical Requirements

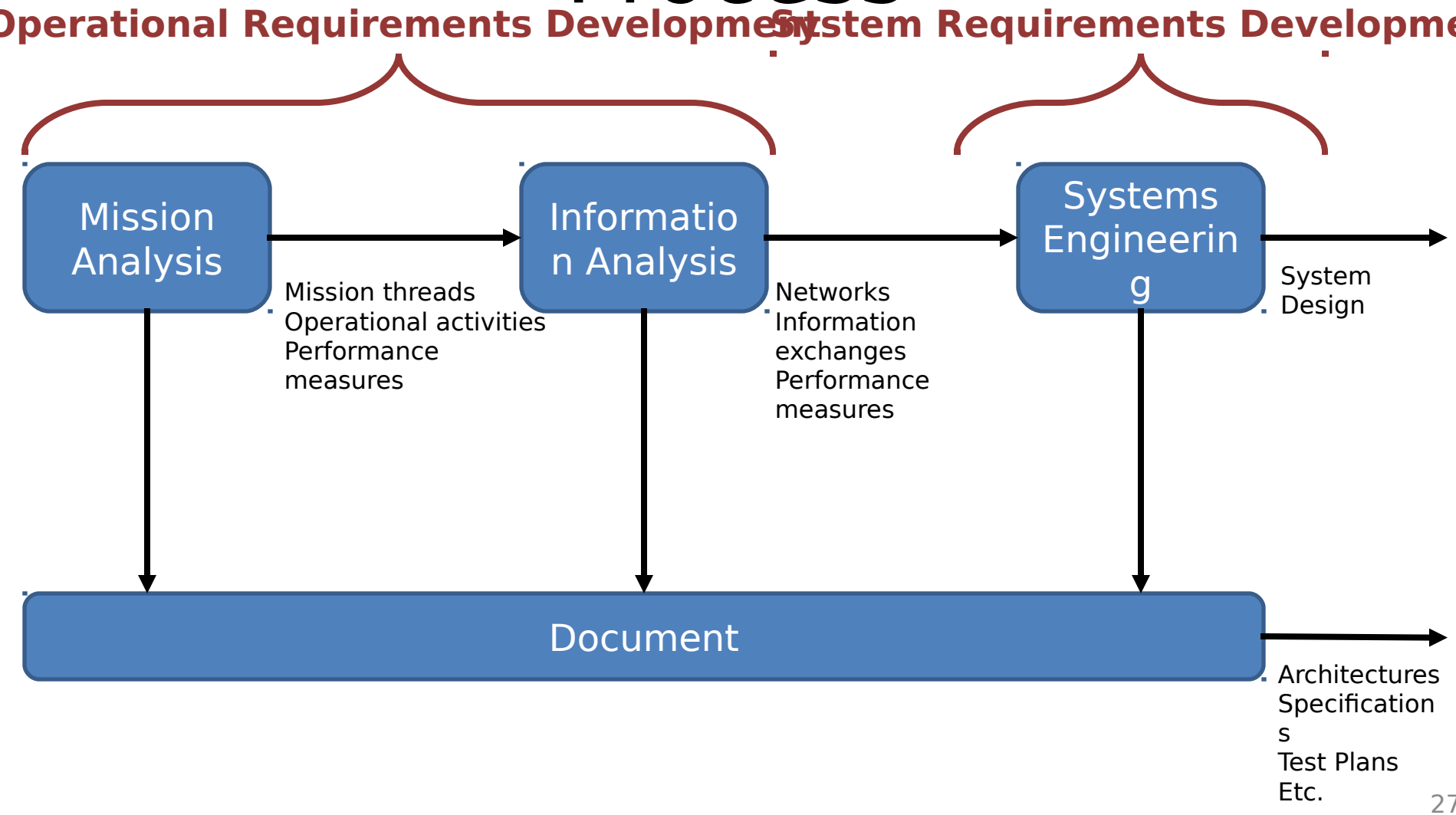
- System Requirements that are derived from Operational Requirements
  - Functions, Interfaces, Connections (Logical and Physical), Data Exchanges
- Technical Requirements
  - Data
  - Services
  - Standards and Standards Profiles
- IA Requirements
- Supportability Requirements
  - Selective Availability Anti-Spoofing Module (SAASM)
  - Spectrum
  - Joint Tactical Radio System (JTRS)

Other 3 Requirements Drive System Technical Require

NR-KPP Manual

- The manual really just describes how to apply Systems Engineering principles to Interoperability Requirements
- Guidebook lays out a 4-step process to implement the NR-KPP.
  1. Perform a **Mission Analysis** to determine NR-KPP operational requirements
  2. Perform an **Information Analysis** to determine information requirements
  3. Apply the **Systems Engineering Process** to NR-KPP operational and information requirements
  4. **Document** outcomes of the process according to engineering practices and compliance measures

Interoperability Requirements Development Process



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Examples

- NOTIONAL – FOR TRAINING PURPOSES ONLY
  - All data is MADE UP by me
- We are fielding 2 new systems
  - Link-16 radio on an aircraft
  - Chat application
- Both systems must support the Joint Close Air Support (JCAS) mission
- Based on JFCOM JCAS JMT

Step 1: Mission Analysis (MA)

- **Methodology**
  - Based on Phase I of the Joint Training System (Enclosure C of CJCSM 3500.03B)
    - Per 3500.03B, the JTS, "identif[ies] the capabilities required to accomplish assigned missions."
  - Steps
    1. Determine assigned mission
    2. Determine mission tasks
    3. Determine essential tasks (joint critical)
    4. Identify organizations, conditions, standards
    5. Identify supporting/command-linked tasks
    6. Review

: A Well-Established Process From The Training Comm

Step 1: Mission Analysis (cont.)

- **Outcomes**
  - Net-Ready Missions
  - Operational Effectiveness Measures describing mission success
  - Net-Ready Operational Tasks
  - Operational Performance Measures describing successful task performance
- **Considerations**
  - MA should be conducted at the enterprise level for each mission (this does not currently happen)
    - Ideally as part of a Capabilities Based Assessment
  - It will be very difficult for a single program or resource sponsor to conduct the MA since it should be done at the enterprise level
  - Should be done as part of a Capabilities Based Assessment (CBA)
  - Results should be included in an Initial Capabilities Document (ICD)

Step 1.1
MA: Determine Mission

- **Objective**
  - Use higher level guidance to determine the Mission Area under consideration
    - Specified in terms of tasks from the UJTL or Agency TL if available
    - If concerned about a single system, the system's intended use may drive the missions
- **Considerations**
  - Mission MOEs will drive all other requirements
  - A system that supports multiple missions (e.g. network infrastructure) should choose a stressing set of missions

Link-16 Example Determine Mission

TA 3.2.2 Conduct Close Air Support

To provide air action by fixed and/or rotary wing aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces. CJCSI 3121.01B, JP 3-09, JP 3-09.3, JP 3-30, JP 3-52

Measures

- *M1 Percent Of close air support requests that resulted in achieving the desired effects.*
- *M2 Percent Of targets attacked that result in fratricide.*
- *M3 Yes/No Does the unit have the capability to conduct Type 1, Type 2, and Type 3 terminal attack control?*
- *M4 Yes/No Was CAS integrated with other fires and maneuver operations?*
- *M5 Percent Of targets attacked that resulted in unintended collateral damage.*
- *M6 Percent Of targets attacked that result in civilian casualties.*

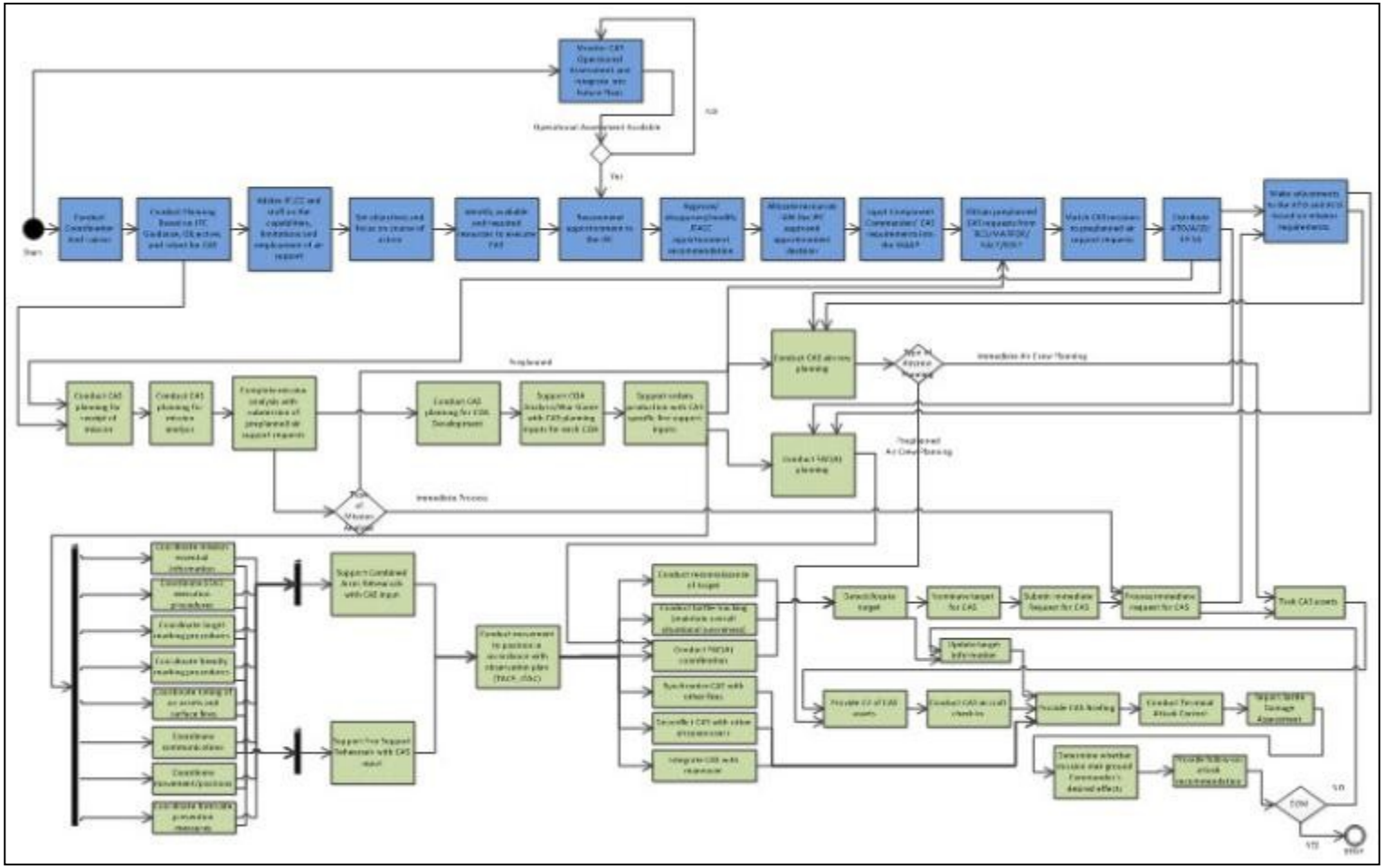
Measures will not always be appropriate for the interoperability requirements and may need to be modified. In this case we will modify measure M1 and make 2 measures

- **M1a: Time to attack target**
- **M2a: Accuracy of engagement**

Step 1.2
MA: Determine Mission Tasks

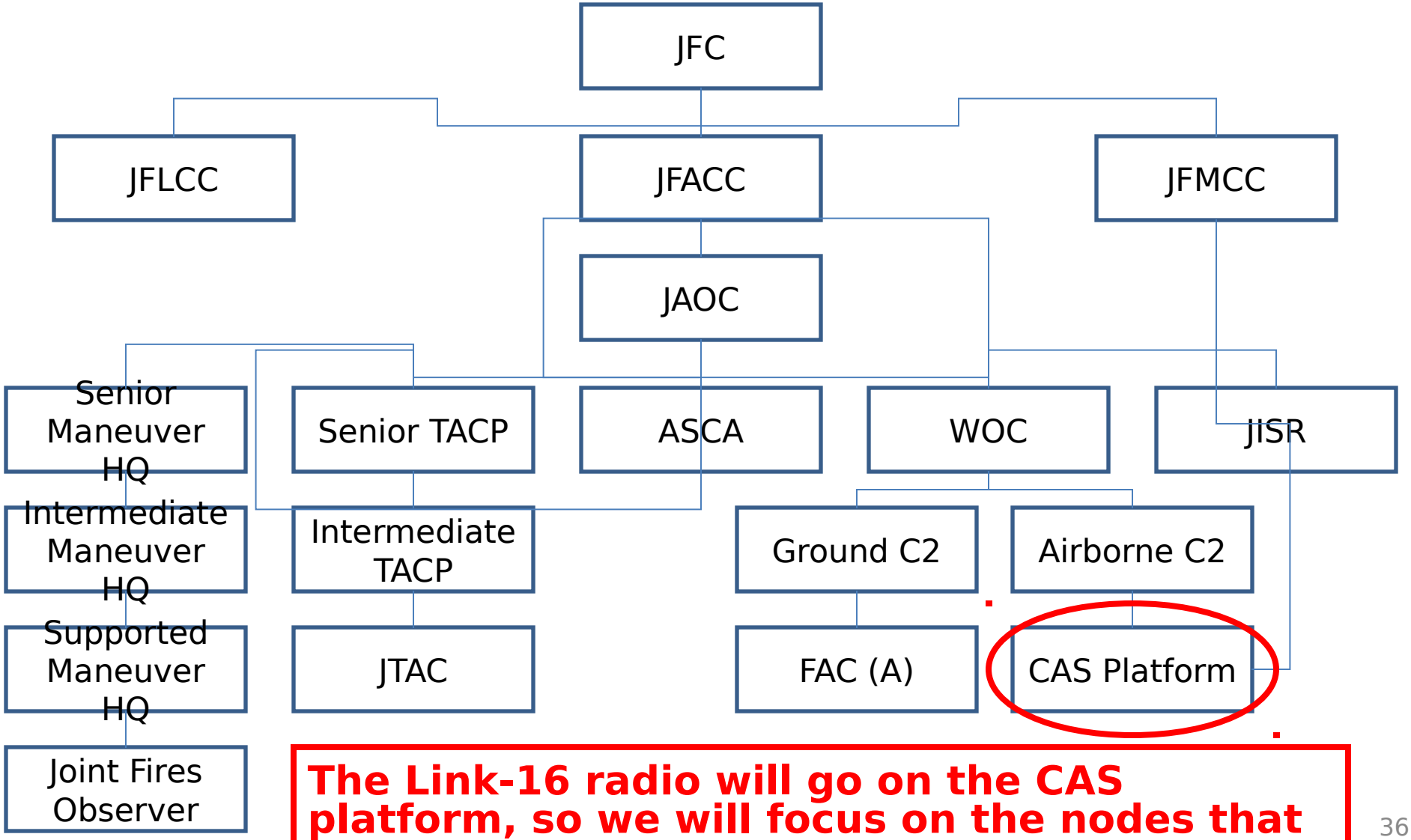
- **Objective**
  - Examine the assigned missions and determine Operational Tasks each mission requires
    - Specified in terms of tasks from the UJTL or Agency TL
  - Identify which Operational Tasks are Net-Ready Operational Tasks
- **Considerations**
  - **This step is Hard**
    - **Requires extensive SME input**
  - Deviate from the JTS and also identify nodes involved in the mission.
    - Makes this step easier since it will help identify Operational Tasks
    - JTS is written from an individual commander's perspective, so it only requires a commander to identify the tasks he/she must do
  - Should identify which Operational Tasks happen one time (event driven) and which happen repeatedly (schedule driven)

Link-16 Example
Determine Mission Tasks



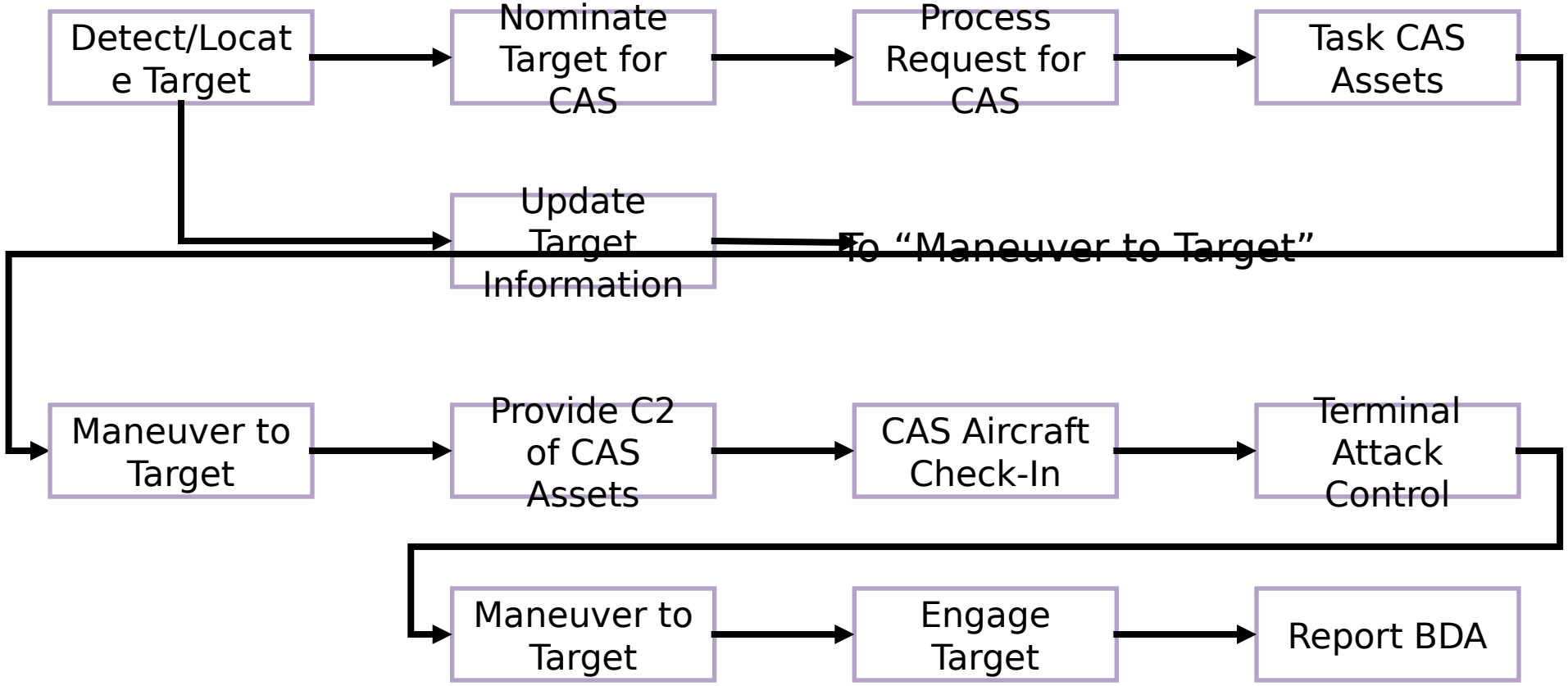
- **Determining all tasks for the entire mission is not trivial and may require more expertise than a single program or resource sponsor has**

Link-16 Example
Determine Mission Tasks



The Link-16 radio will go on the CAS platform, so we will focus on the nodes that

Link-16 Example
Determine Mission Tasks



- **Identify all operational tasks required to successfully complete the mission. Tasks above are a slice of a JCAS Mission thread.**
- **Initially write down operational tasks in plain English.**

Link-16 Example
Determine Mission Tasks

MCT 2.2.1
Conduct Tactical Reconnaissance
M6: Hours to provide data

MCT 3.1.2.4
Nominate Targets for Submission to JIPTL
MX: Time to complete

OP 3.1.3
Develop Operational Targets
M1: Hours to select targets to attack

OP 3.1.2
Apportion Joint Firepower Resources
M1: Hours to assign firepower resources

NTA 2.3.1.1
Provide Communications Tasking
M1: Minutes to transmit
MX1: Area of uncertainty

- **Task lists provide standardized language to describe tasks as well as standardized metrics**
- **Plain English description should be included in notes**

MCT 3.2.5.2
Control CAS
M13: Time to respond

TA 5.5.1
Conduct Force Link Up
MX1: Time to complete

MCT 3.2.7.4
Conduct JTAC Ops
MX1: Area of uncertainty
MX2: Time to complete

NTA 1.1
Move (AF) Tactical Forces
M1: Rate of movement

AFT 2.1.1
Perform Lethal Precision Engagement
M1: Time to achieve desired effects
M2: Distance from desired impact

MCT 2.2.6
Collect BDA
M1: Time to gather intelligence

Step 1.3
MA: Determine Essential Tasks

- **Objective**
  - Identify Operational Tasks within the mission
  - If the interoperability requirements are for a single system, identify which Operational Tasks are supported by that system
  - Identify which of those tasks are Joint Critical tasks
- **Considerations**
  - Joint Critical Tasks distinguish between the threshold and objective requirements of the NR-KPP
  - Even though a system may not support all tasks within a mission, all the tasks must be identified so that individual task performance can be specified to ensure mission success
  - Mission Area vs. Mission Thread

Link-16 Example
Determine Mission Tasks

MCT 2.2.1
Conduct Tactical Reconnaissance
M6: Hours to provide data

MCT 3.1.2.4
Nominate Targets for Submission to JIPTL
MX: Time to complete

OP 3.1.3
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OP 3.1.2
Apportion Joint Firepower Resources
M1: Hours to assign firepower resources

ST
NTA 2.3.1.1
Provide Cueing
M1: Minutes to transmit
MX1: Area of uncertainty

- **ST = Tasks the Link-16 system will support**
- **JC = System tasks that are Joint Critical**

MCT 3.2.5.2
Control CAS
M13: Time to respond

JC
TA 5.5.1
Conduct Force Link Up
MX1: Time to complete

JC
MCT 3.2.7.4
Conduct JTAC Ops
MX1: Area of uncertainty
MX2: Time to complete

NTA 1.1
Move (AF) Tactical Forces
M1: Rate of movement

JC
AFT 2.1.1
Perform Lethal Precision Engagement
M1: Time to achieve desired effects
M2: Distance from desired impact

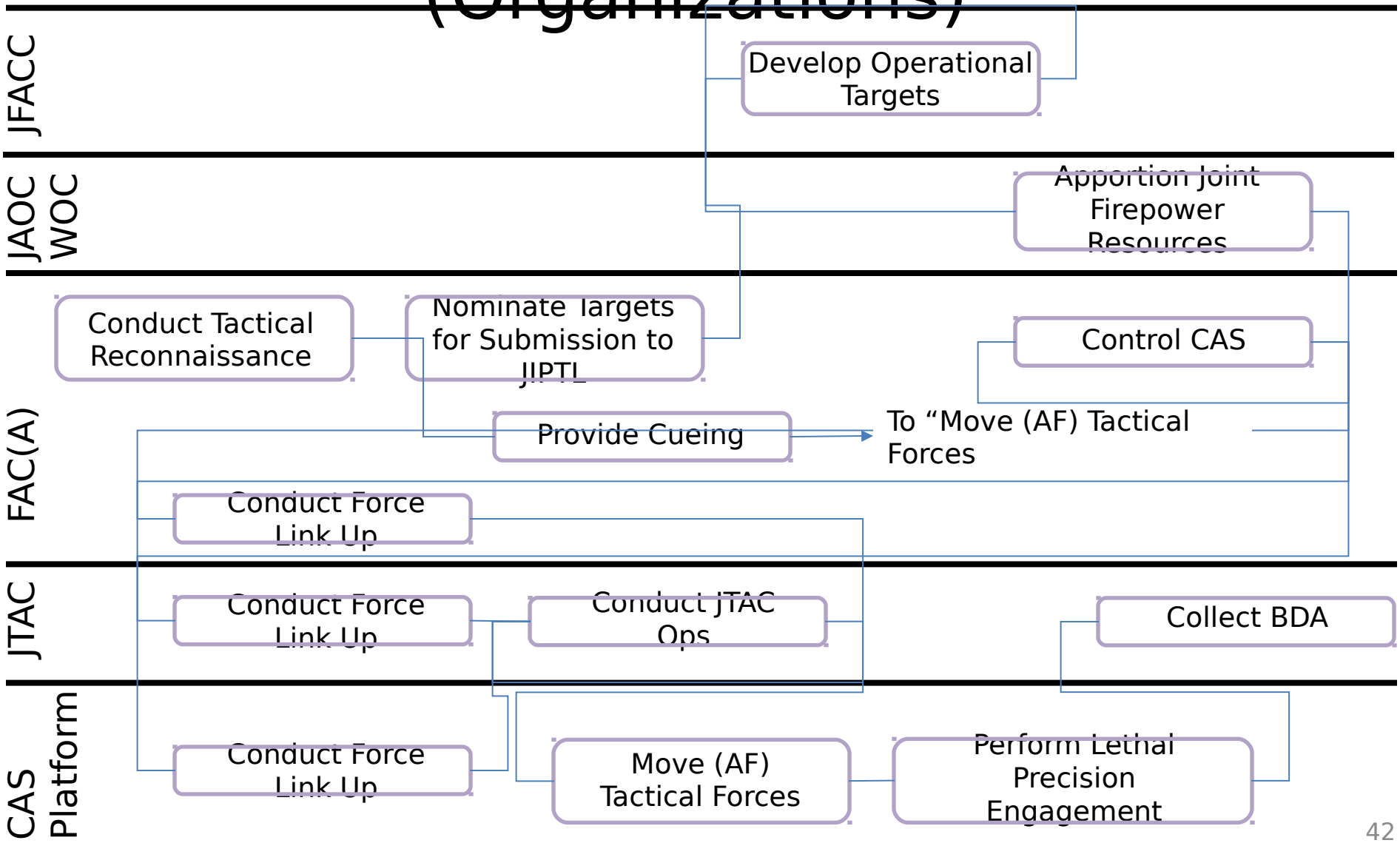
MCT 2.2.6
Collect BDA
M1: Time to gather intelligence

Step 1.4

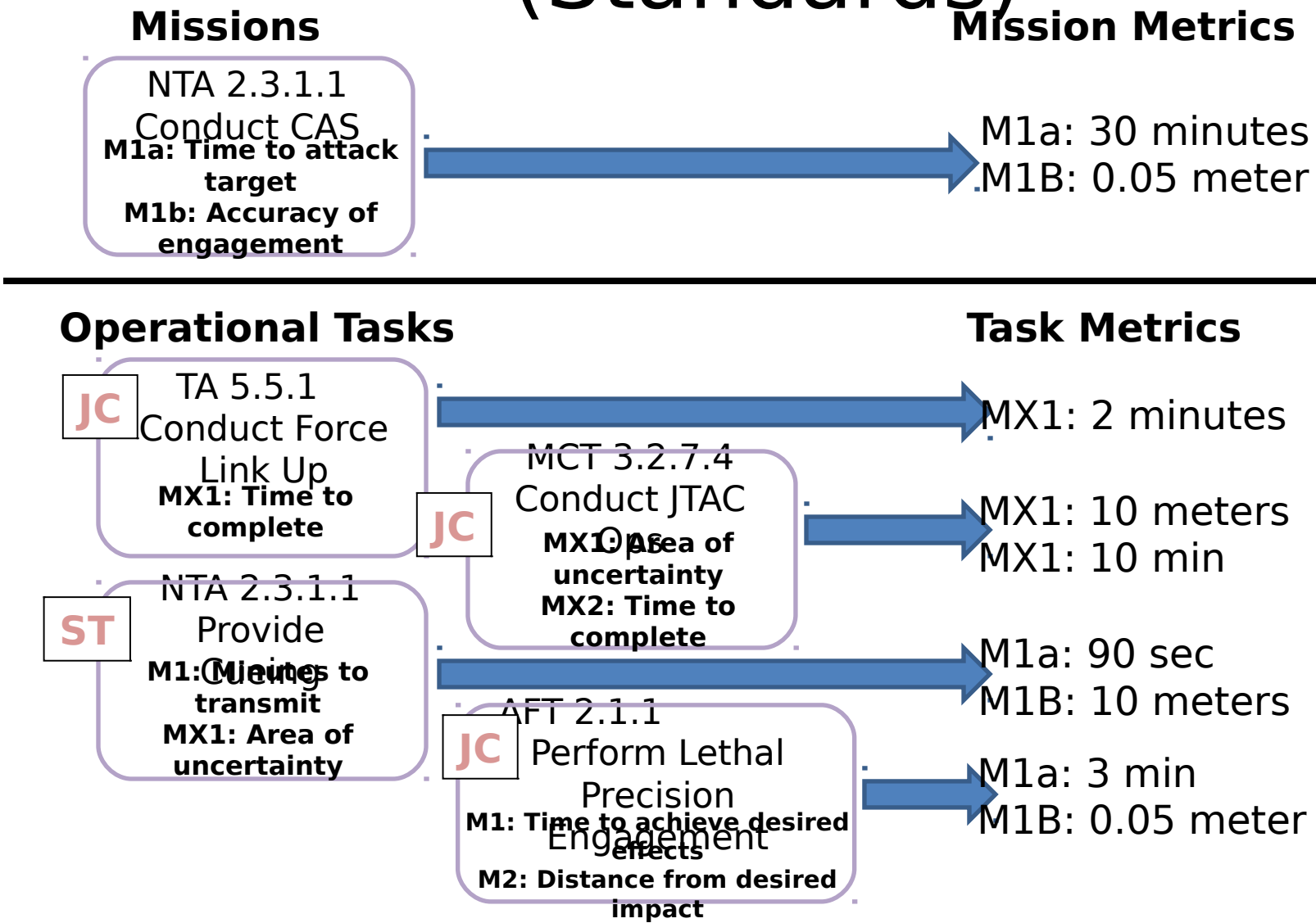
MA: Identify Organizations, Conditions, and Standards

- **Objective**
  - Determines effectiveness metrics for each mission
  - Determine operational performance metrics for each task
  - Determine conditions under which each task must be executed
    - Including Information Assurance environment
  - Determine nodes that will execute each task.
- **Considerations**
  - Conditions and Standards for Operational Tasks must be such that Conditions and Standards for the Mission are met
  - This is where Systems of Systems Engineering takes place since multiple systems must be combined to accomplish a mission
  - Mission Area vs. Mission Thread

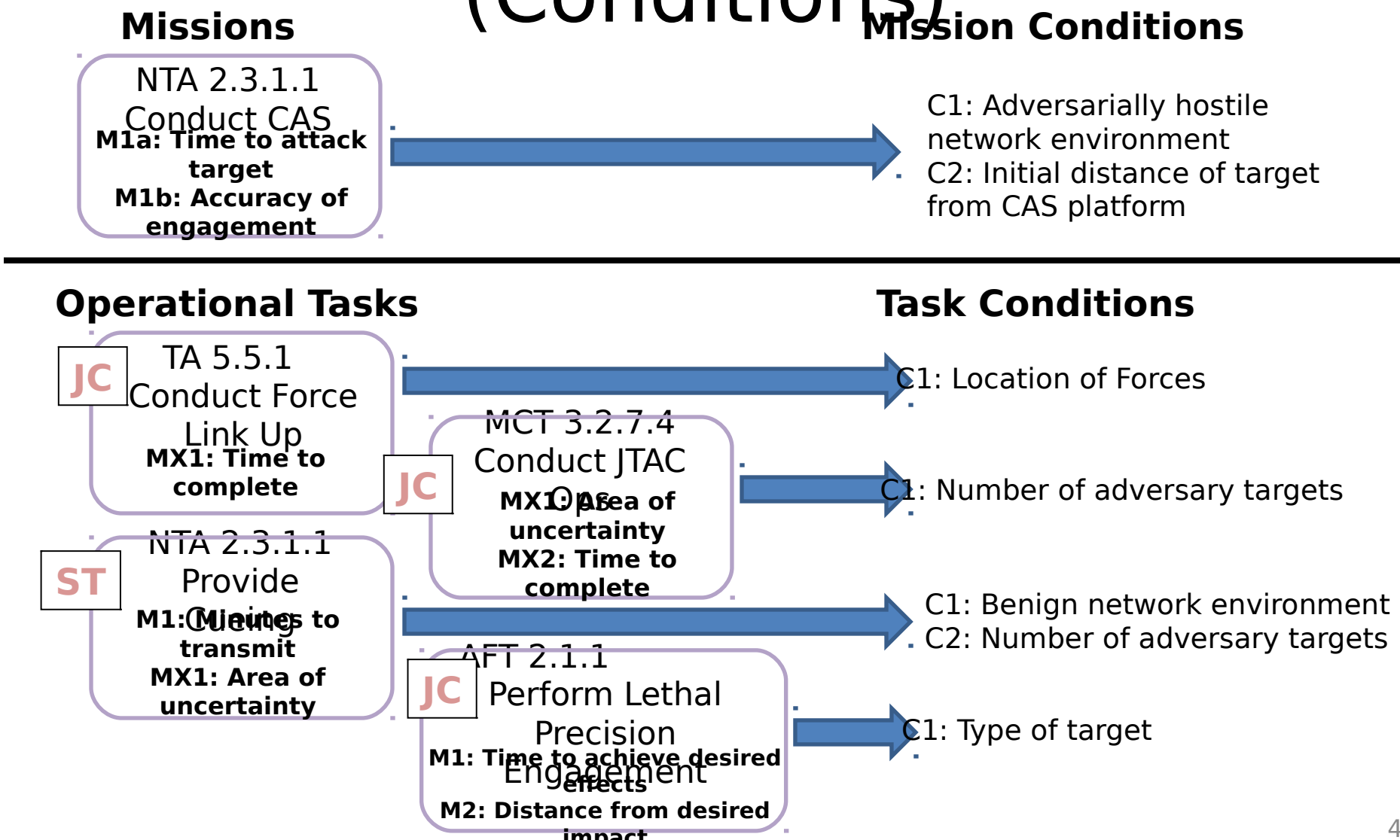
Link-16 Example
Determine Mission Tasks (Organizations)



Link-16 Example Determine Mission Tasks (Standards)



Link-16 Example Determine Mission Tasks (Conditions)



Step 1.5
MA: Supporting/Command-Linked Tasks

- **Objective**
  - Double check that all tasks and nodes associated with each mission have been identified
- **Considerations**
  - MA steps are iterative, so this may be redundant
  - Explicitly consider Joint or Coalition nodes
  - Call out where Unanticipated User might come in

Step 1.6
MA – Review

- **Objective**
  - Ensures the appropriate stakeholders have the opportunity to comment on the work conducted so far
  - One last sanity check to make sure things make sense
- **Considerations**
  - Ensure warfighters review
  - We described the process linearly, but many of the steps are iterative

Link-16 Example MA Outputs

KPP		Threshold	Objective
Mission			
Conduct CAS	M1a: Time to attack target M1b: Accuracy of engagement C1: Adversarially hostile network environment C2: Initial distance of target from CAS platform	30 minutes 0.05meter	30 minutes 0.05meter
Operational Task			
Conduct Force Link Up	MX1: Time to complete C1: Location of Forces	2 minutes	2 minutes
Provide Cueing	M1: Minutes to transmit MX1: Area of uncertainty C1: Benign network environment C2: Number of adversary targets	Not joint critical	90 seconds 10 meters
Conduct JTAC OPS	MX1: Area of uncertainty MX2: Time to complete C1: Number of adversary targets	10 meters 10 minutes	10 meters 10 minutes
Perform Lethal	M1: Time to achieve desired effects	3 minutes	3 minutes

Chat Example
MA Outputs

KPP		Threshold	Objective
Mission			
Conduct CAS	M1a: Time to attack target M1b: Accuracy of engagement C1: Adversarially hostile network environment C2: Initial distance of target from CAS platform	30 minutes 0.05meter	30 minutes 0.05meter
Operational Task			
Conduct Force Link Up	MX1: Time to complete C1: Location of Forces	2 minutes	2 minutes
Conduct Tactical Reconnaissance	M6: Time to provide data C1: EMCON conditions	30 minutes	30 minutes
Conduct JTAC OPS	MX1: Area of uncertainty MX2: Time to complete C1: Number of adversary targets	10 meters 10 minutes	10 meters 10 minutes
Nominate Targets for Submission to JIPTL	MX1: Time to complete C1: EMCON conditions	45 minutes	45 minutes

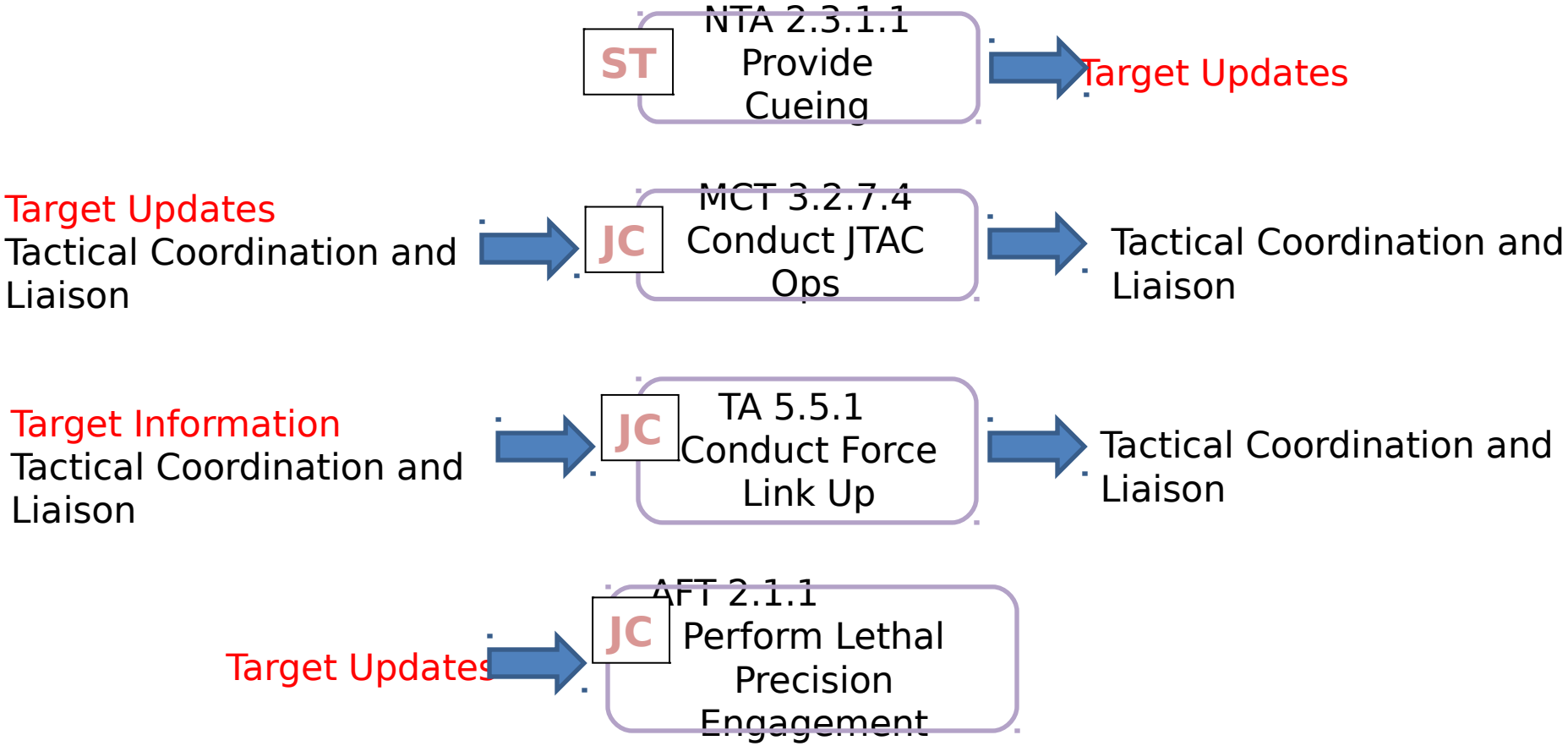
Step 2: Information Analysis (InA)

- **Methodology**
  - No authoritative methodology exists, so the ASN (RDA) CHSENG NR-KPP Implementation Guidebook recommends its own process
  - Steps
    1. Determine Information Elements
    2. Determine Networks
    3. Determine Entry and Management Requirements
    4. Identify Performance Requirements
- **Outcomes**
  - Information elements produced or consumed by each Operational Task
  - Networks needed to support the information elements
  - Operational Performance metrics for network entry and management
  - Operational Performance metrics for information elements

Step 2.1
InA: Information Elements

- **Objective**
  - Determine the Information Elements associated with successful completion of each Operational Task
    - What information is needed to complete the task successfully
    - What information is produced as a result of successful task completion
- **Considerations**
  - If the requirements are being developed for a single system
    - Only need to identify the information elements for the tasks that the system will support
    - Even though the system may not support all information elements associated with an Operational Task, all information elements for the task should be identified

Link-16 Example Determine Information Elements



nk-16 radio will support the information elements in red

Step 2.2
InA: Networks

- **Objective**
  - Determine the networks required to transport the Information Elements in Step 2.1.
- **Considerations**
  - These are not just IP networks
- **Link-16 Example**
  - In our example, Target Information and Target Updates are transported via a Link-16 Network

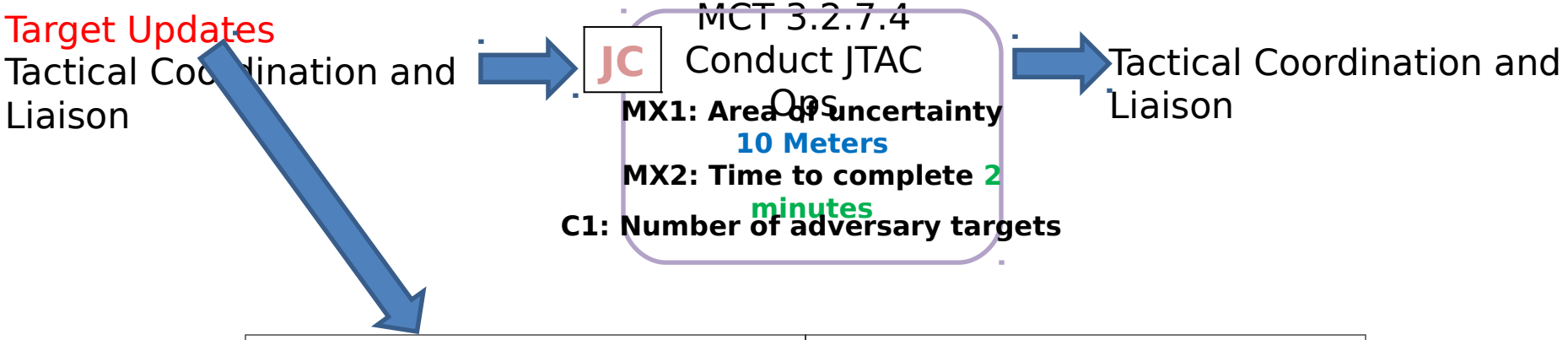
InA 2.3
Network Entry and Management

- **Objective**
  - Determine the entry and management requirements for the networks the system will connect to
    - Operational Performance Metrics
    - Conditions under which entry and management will occur
- **Considerations**
  - Consider Information Assurance environment
  - There is no standardized list of requirements, but some of them might be
    - Who will manage the system as it connects to various networks?
    - How will the system be managed? Will management be distributed, centralized, local, remote, etc.?
    - What configuration parameters does the network have?
- **Link-16 Example**
  - The CAS platform has 2 minutes to conduct Joint Force Link Up. Therefore, it must connect to the Link-16 network in less than 2 minutes.
  - The CAS platform will be on the tactical edge, therefore network management must be remote or controlled by the radio itself

Step 2.4
InA: Information Element Performance

- **Objective**
  - Determines the performance requirements for each of the Information Elements.
- **Considerations**
  - Performance requirements for the information elements must be such that performance requirements for the Operational Tasks are met

Link-16 Example
Determine Information Element Performance



Operational Performance Metric	**Value**
Source	JTAC
Destination	CAS Platform
Periodicity	< 2 Minutes
Timeliness	< 60 Seconds
Accuracy	< 10 Meters CEP
Information Assurance	Availability, Integrity, Confidentiality

Information Assurance requirements are derived from the conditions for Mission performance (C1: Adversarially hostile network environment)

Link-16 Example InA Outputs

KPP		Threshold	Objective
Enter and Be Managed In The Network			
Connect to Link-16 Network	M1: Time to connect C1: Adversarially hostile network environment	3 minutes	2 minutes
Be Managed In Link-16 Network	M1: Location of manager C1: Adversarially hostile network environment	Remote and in radio	Remote and in radio
Information Exchanges			
Target Information	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	See separate table	See separate table
Target Updates	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	See table on previous slide	See table on previous slide

Chat Example InA Outputs

KPP		Threshold	Objective
Enter and Be Managed In The Network			
Connect to SIPRNET	M1: Time to connect C1: Adversarially hostile network environment	3 minutes	2 minutes
Connect to NIPRNET	M1: Time to connect C1: Benign network environment	Not joint critical	2 minutes
Be Managed on NIPRNET and NIPRNET	M1: Location of manager C1: Adversarially hostile network environment	Remote and in radio	Remote and in radio
Information Exchanges			
Tactical Coordination and Liaison	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	Separate table	Separate table
Target Information	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	Separate table	Separate table
JTAR Approval/Disapproval Information	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	Separate table	Separate table

Overall Example Link-16 Interoperability Requirements

KPP		Threshold	Objective
Mission			
Conduct CAS	M1a: Time to attack target M1b: Accuracy of engagement C1: Adversarially hostile network environment C2: Initial distance of target from CAS platform	30 minutes 1 meter	30 minutes 1 meter
Operational Task			
Conduct Force Link Up	MX1: Time to complete C1: Location of Forces	2 minutes	2 minutes
Provide Cueing	M1: Minutes to transmit MX1: Area of uncertainty C1: Benign network environment C2: Number of adversary targets	Not joint critical	90 seconds 10 meters
Conduct JTAC OPS	MX1: Area of uncertainty MX2: Time to complete C1: Number of adversary targets	10 meters 10 minutes	10 meters 10 minutes
Perform Lethal Precision Engagement	M1: Time to achieve desired effects M2: Distance from desired impact C1: Type of target	3 minutes 1 meter	3 minutes 1 meter
Enter and Be Managed In The Network			
Connect to Link-16 Network	M1: Time to connect C1: Adversarially hostile network environment	3 minutes	2 minutes
Be Managed In Link-16 Network	M1: Location of manager C1: Adversarially hostile network environment	Remote and in radio	Remote and in radio
Information Exchanges			
Target Information	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	See separate table	See separate table
Target Updates	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	See table on previous slide	See table on previous slide

Overall Example Chat Interoperability Requirements

	KPP	Threshold	Objective
Mission			
Conduct CAS	M1a: Time to attack target M1b: Accuracy of engagement C1: Adversarially hostile network environment C2: Initial distance of target from CAS platform	30 minutes 1 meter	30 minutes 1 meter
Operational Task			
Conduct Force Link Up	MX1: Time to complete C1: Location of Forces	2 minutes	2 minutes
Conduct Tactical Reconnaissance	M6: Time to provide data C1: EMCON conditions	30 minutes	30 minutes
Conduct JTAC OPS	MX1: Area of uncertainty MX2: Time to complete C1: Number of adversary targets	10 meters 10 minutes	10 meters 10 minutes
Nominate Targets for Submission to JIPTL	MX1: Time to complete C1: EMCON conditions	45 minutes	45 minutes
Enter and Be Managed In The Network			
Connect to SIPRNET	M1: Time to connect C1: Adversarially hostile network environment	3 minutes	2 minutes
Connect to NIPRNET	M1: Time to connect C1: Benign network environment	Not joint critical	2 minutes
Be Managed on NIPRNET and NIPRNET	M1: Location of manager C1: Adversarially hostile network environment	Remote and in radio	Remote and in radio
Information Exchanges			
Tactical Coordination and Liaison	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	Separate table	Separate table
Target Information	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	Separate table	Separate table
JTAR Approval/Disapproval Information	Measures for Periodicity, Timeliness, Accuracy, and Information Assurance	Separate table	Separate table

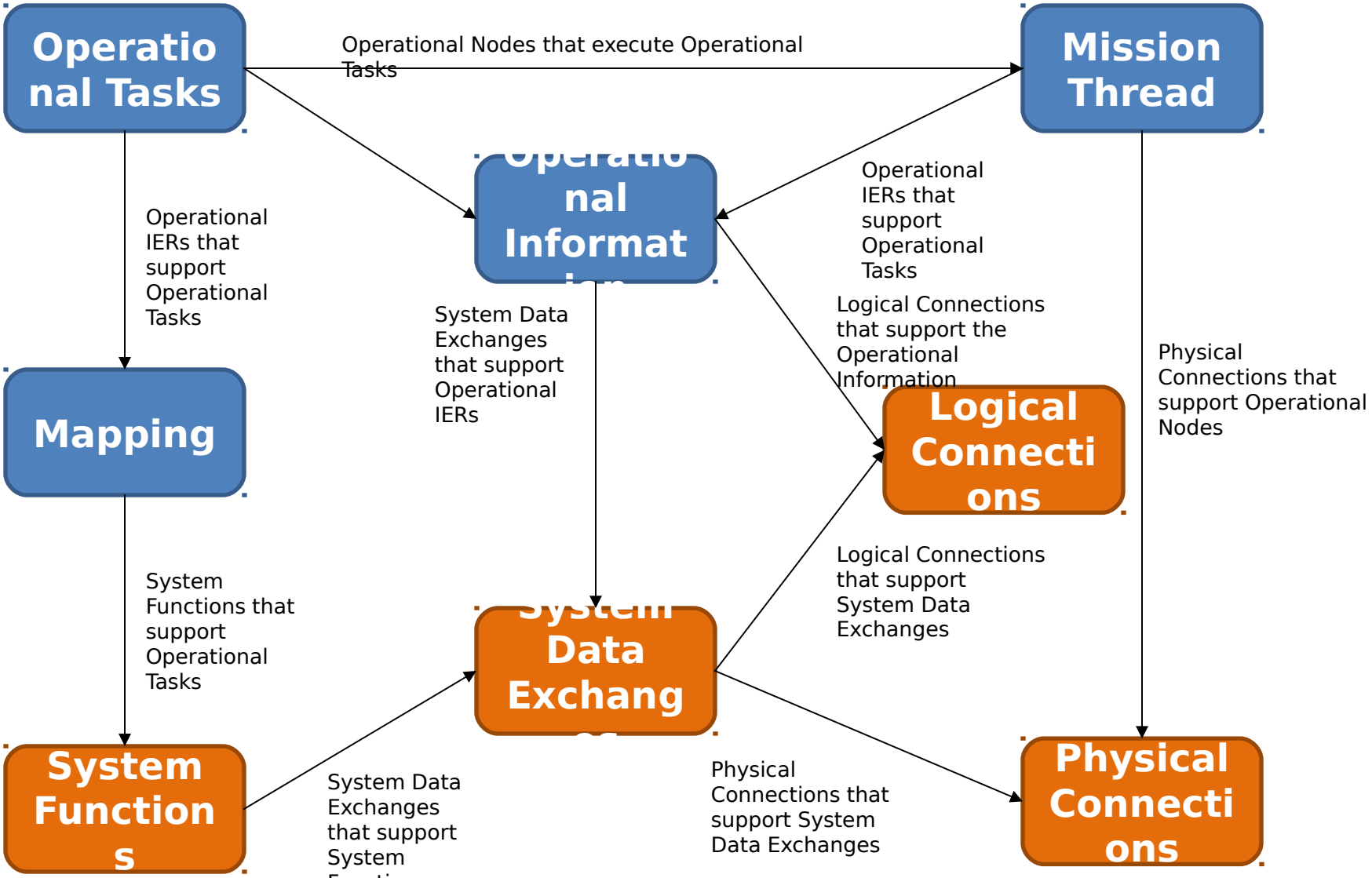
Step 3: Systems Engineering

- **Methodology**
  - Use an approved Systems Engineering Process to ensure the fielded systems satisfy the requirements identified in the Mission Analysis and Information Analysis
    - Defense Acquisition Guidebook (DAG) process
    - IEEE Standard 1220
- **Outcomes**
  - System Requirements that are derived from Operational Requirements
  - Technical Requirements
  - IA Requirements
  - Supportability Requirements

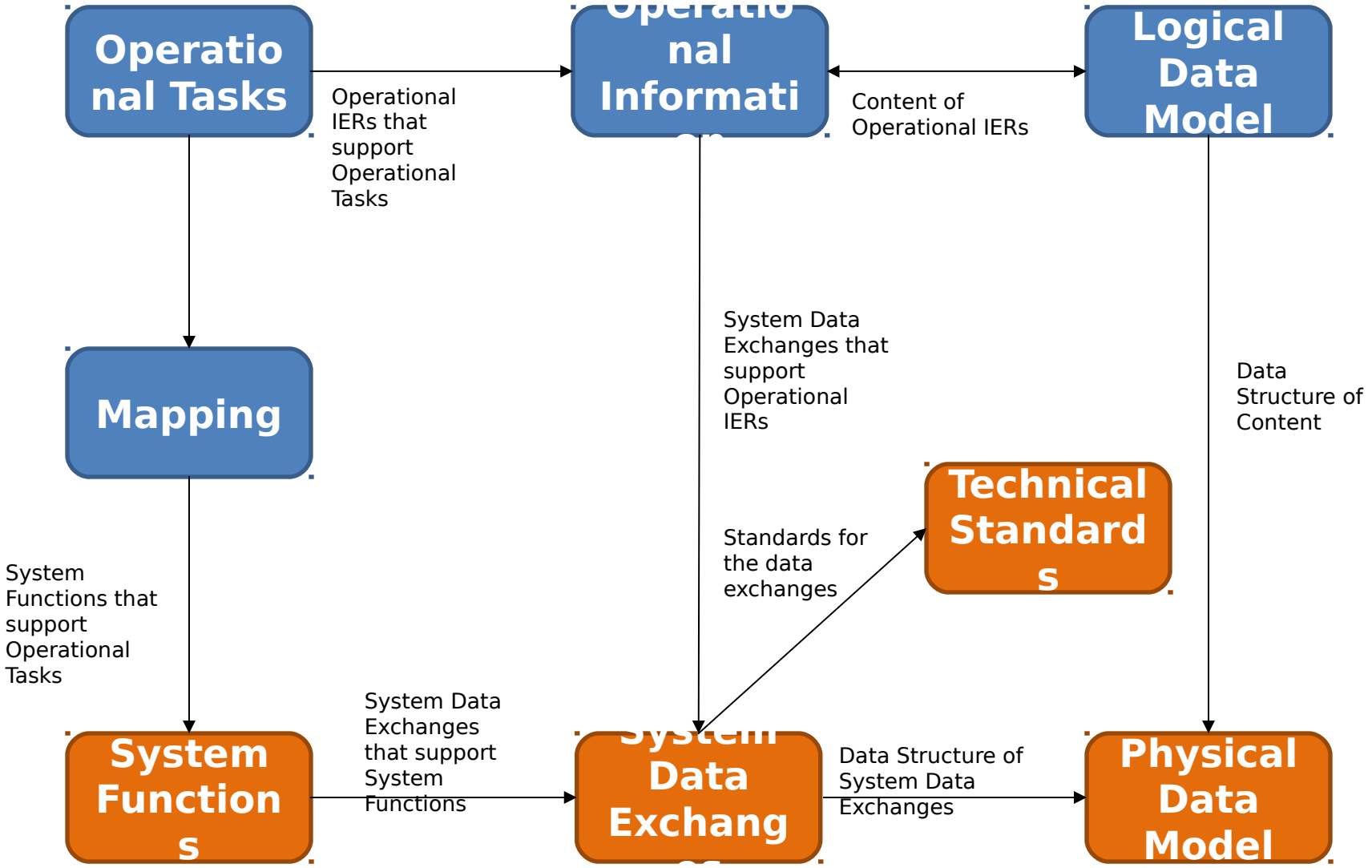
Satisfying the Operational Requirements

- Determine what **system functions** will support the required Operational Tasks
- Identify what **system data exchanges** are produced and consumed by the system functions
- Determine **performance metrics for the system functions** that ensure performance metrics of Operational Tasks will be met
- Determine **physical connections** to nodes that must be communicated with to successfully complete Operational Tasks
- Determine **performance metrics for system data exchanges** that ensure system function performance requirements are met and operational information elements are met
- Define the **structure of each data element** in a system data exchange
- Determine **logical connections** between applications on different nodes that must exchange information to successfully complete the Operational Tasks
- Identify **standards** used for all the system requirements above

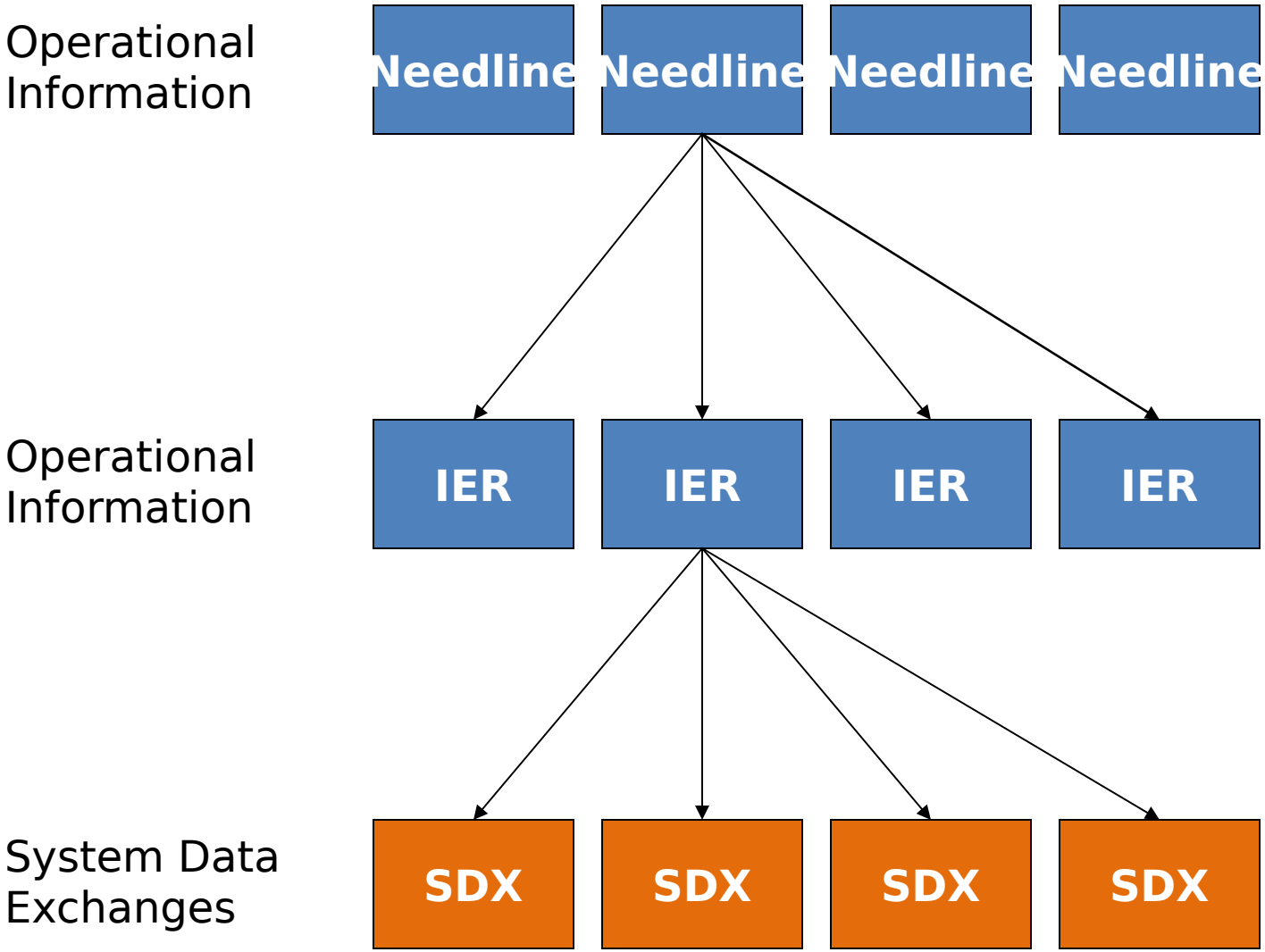
Satisfying the Operational Requirements


Operational Tasks
Operational Nodes that execute Operational Tasks
Mission Thread
Operational Information
Operational IERs that support Operational Tasks
Operational IERs that support Operational Tasks
Logical Connections that support the Operational Information
Physical Connections that support Operational Nodes
Mapping
System Data Exchanges that support Operational IERs
Logical Connections
System Functions that support Operational Tasks
Logical Connections that support System Data Exchanges
System Data Exchanges
System Functions
System Data Exchanges that support System Functions
Physical Connections that support System Data Exchanges
Physical Connections

Satisfying the Operational Requirements



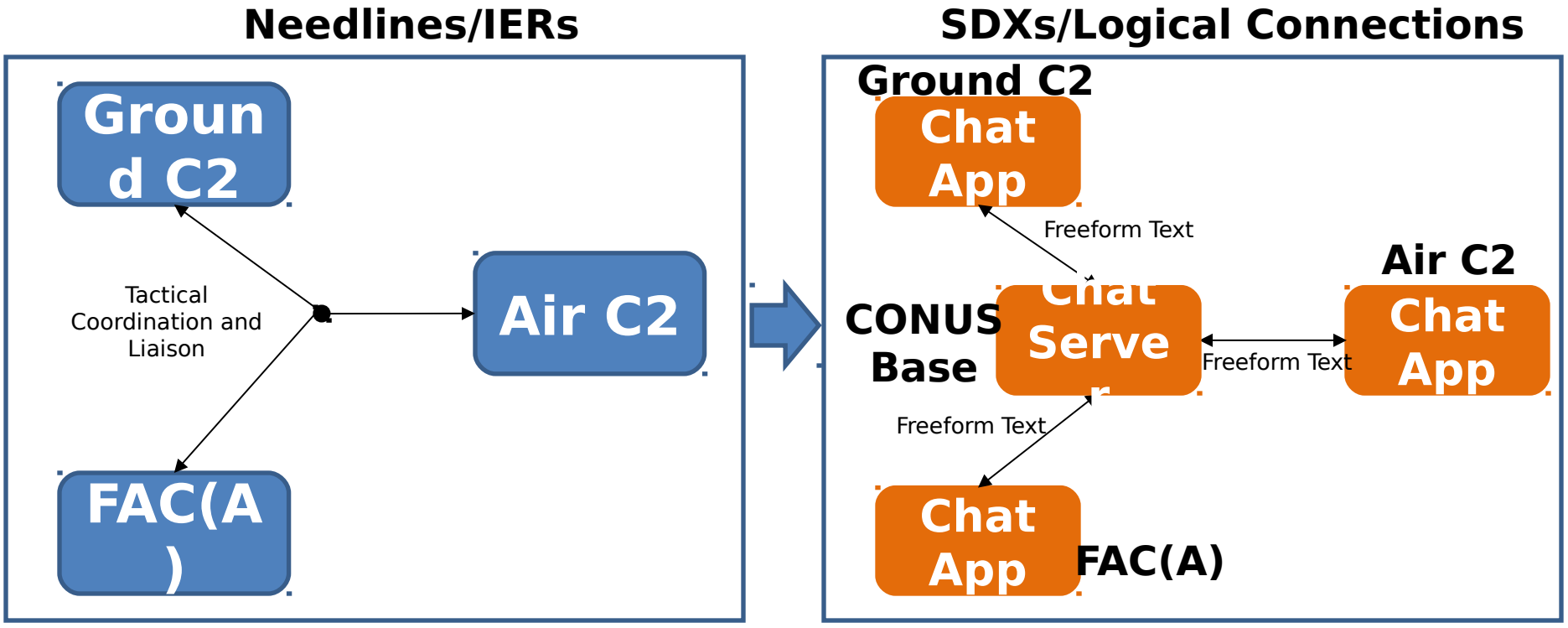
Satisfying the Operational Requirements



Derived System Technical Requirements

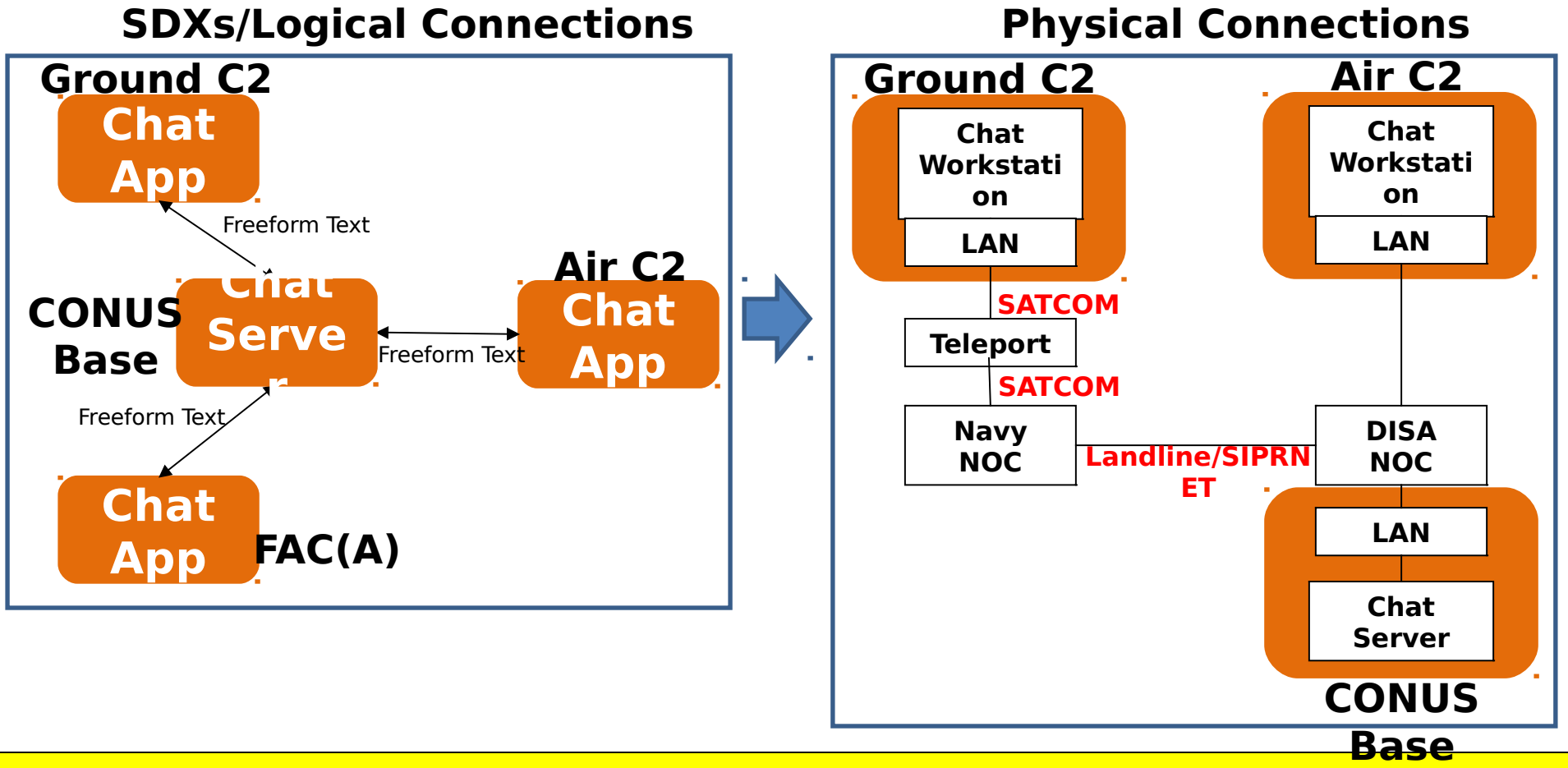
- Comply with the Net-Centric Data Strategy, Net-Centric Services Strategy, DoD Information Enterprise Architecture (where applicable)
  - System functions
  - System data exchanges
  - Data elements
- Comply with Global Information Grid (GIG) Enterprise Service Profiles (GESPs)
  - Logical interfaces
  - Physical interfaces
  - Standards
- Comply with IA requirements, specify IA controls
  - Logical interfaces
  - Physical interface
  - System functions
  - System data exchange
- Comply with spectrum and supportability requirements to include Selective Availability Anti-Spoofing Module (SAASM), Spectrum, and Joint Tactical Radio System (JTRS) requirements
  - Each physical interface or system function that uses the electromagnetic spectrum

Chat Example
Needlines and IERS



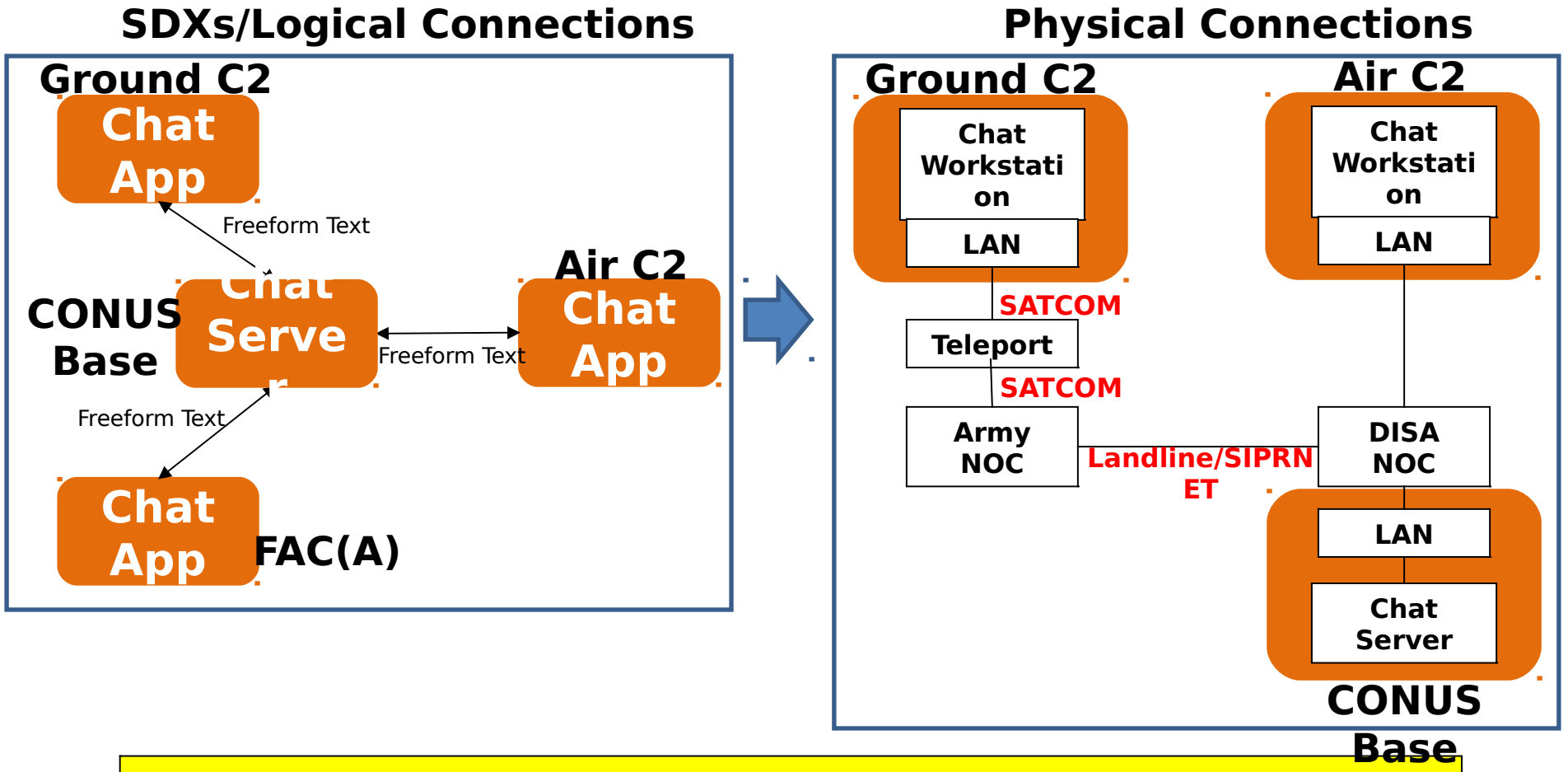
and Logical Connections Should Satisfy Needlines and
s well as network entry and management requirement

Chat Example
SDXs and Logical Connections



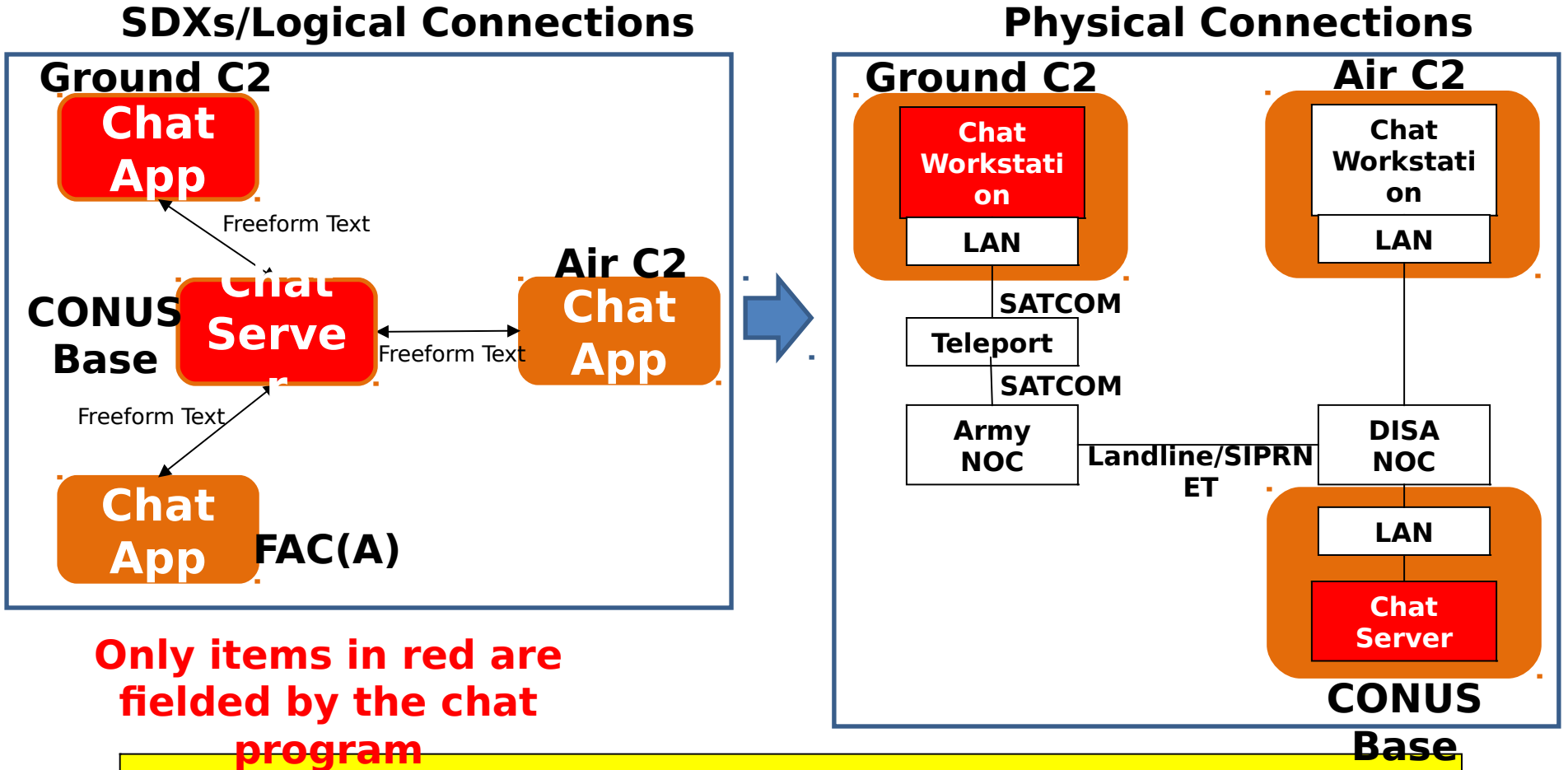
al Connections Should Enable SDXs and Logical Conne

Chat Example
IA, Standards, Data Formats



IA, Standards, Data Format Specified for Every SDX, Logical Connection, Physical Connection

Chat Example
Other Program Dependencies



Only items in red are fielded by the chat program

Interface Agreements/Standards, Service Level Agreements Should Be Developed For All External Programs

Step 4: Documentation

- **Methodology**
  - Simply document the outcomes of the process using an approved, reusable format
    - DoDAF
    - CDF
    - UML
    - Toilet paper and crayon???
    - Other?
  - Make sure the artifacts are usable throughout a program's lifecycle
    - JCIDS documents
    - SEPs
    - Contract specs
    - Test Documents
- **Outcomes**
  - Artifacts that describe the Interoperability Requirements and how the system is meeting those requirements

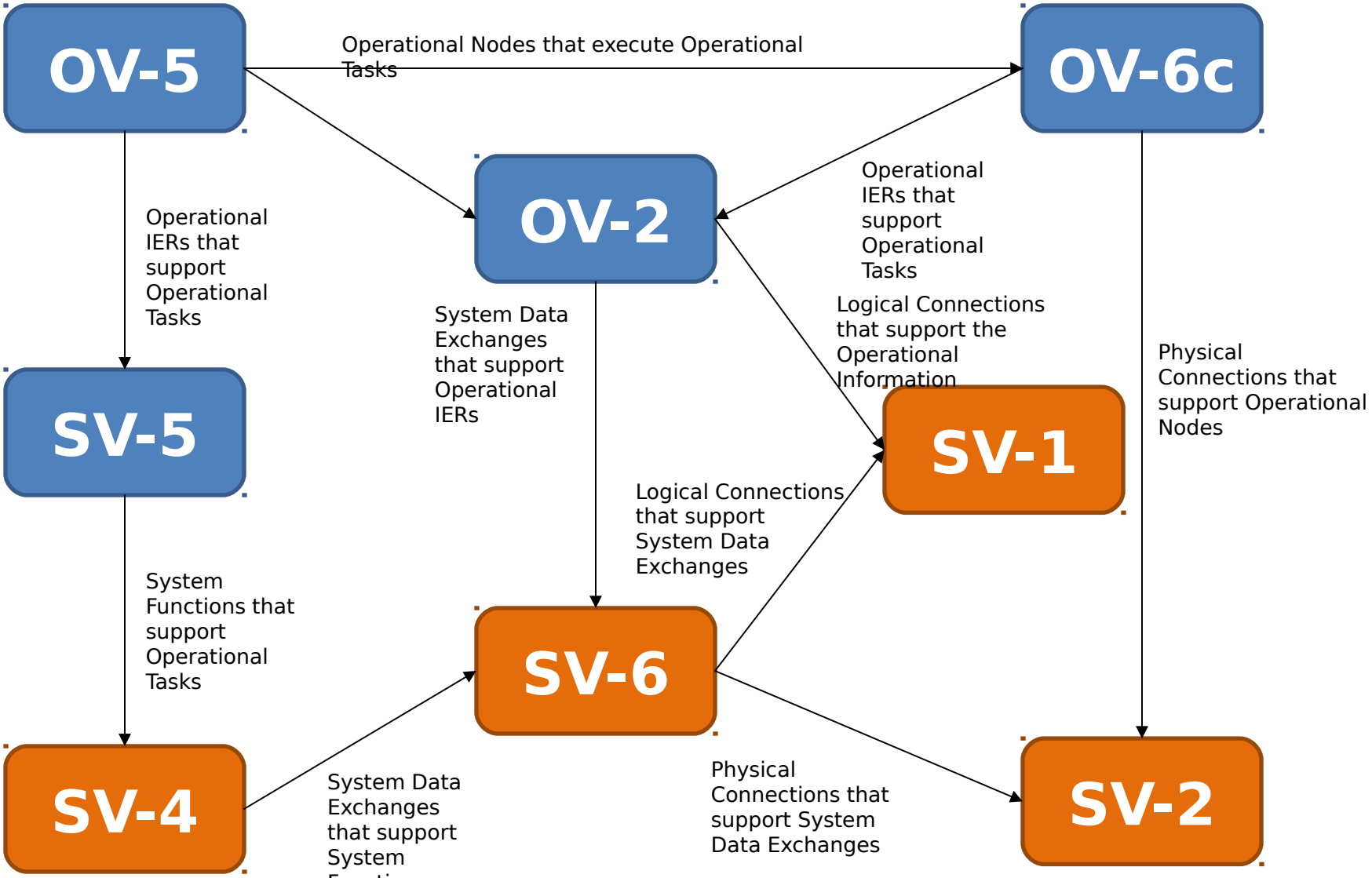
Documenting A System's Operational Requirements

- An **AV-1** should provide the context and scope of the missions a system supports.
- An **OV-1** (or multiple OV-1s) should display the missions a system supports.
- An **OV-4** can display the command hierarchy and external nodes needed for the mission.
- An **OV-6c** should display the sequence of activities in the mission.
- An **OV-2** should display a summary of the Information Elements produced and consumed.
- An **OV-3** should display the Information Elements produced and consumed along with their Operational Performance Measures.
- A full **OV-5** should display each activity in the mission and the Information Elements produced and consumed by that activity.
- An **OV-7** should display the Information Elements' Logical Data Model to start planning the program's data strategy.
- The required networks form the starting point for an **SV-2**
- An **AV-2** should contain a dictionary of terms used in these architecture products.

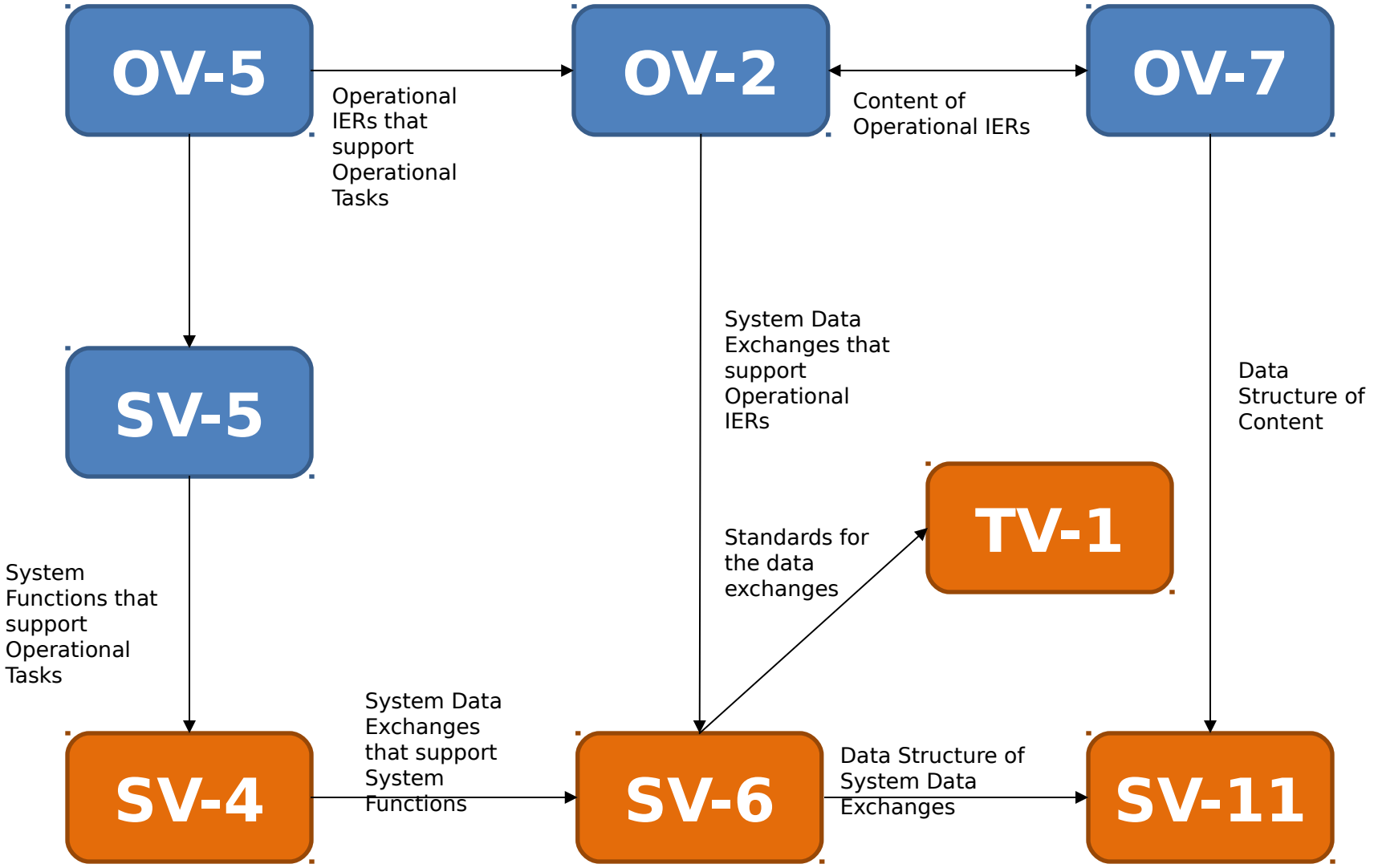
Documenting A System's Technical Solution

- An **SV-1** should display the system's logical interfaces
- An **SV-2** should display the system's physical interfaces
- An **SV-4a** should display the functions a system performs along with the data produced and consumed by each function
- An **SV-5a** should display how the system's functionality supports the missions and Operational Tasks identified during the MA
- An **SV-6** should display the system data exchanges supporting the information flows identified during the InA and displayed in the OV-2, OV-3, and SV-4a. The SV-6 also displays performance requirements for each system data exchange.
- An **SV-11** should display the content of the system data exchanges identified in the SV-6
  - The SV-11 also displays the details of the Information Elements in the OV-7.
- A **TV-1** should display the standards used by the system interfaces in the SV-1 and SV-2, the system functions in the SV-4, the system data exchanges in the SV-6, and the system data in the SV-11. A TV-2 should display any expected changes in those standards.
- An **AV-2** should contain a dictionary of terms used in these architecture products.

Documenting the Requirements


OV-5
Operational Nodes that execute Operational Tasks
OV-6c
OV-2
Operational IERs that support Operational Tasks
Operational IERs that support Operational Tasks
System Data Exchanges that support Operational IERs
Logical Connections that support the Operational Information
Physical Connections that support Operational Nodes
SV-5
SV-1
Logical Connections that support System Data Exchanges
System Functions that support Operational Tasks
SV-6
SV-4
System Data Exchanges that support System Functions
Physical Connections that support System Data Exchanges
SV-2

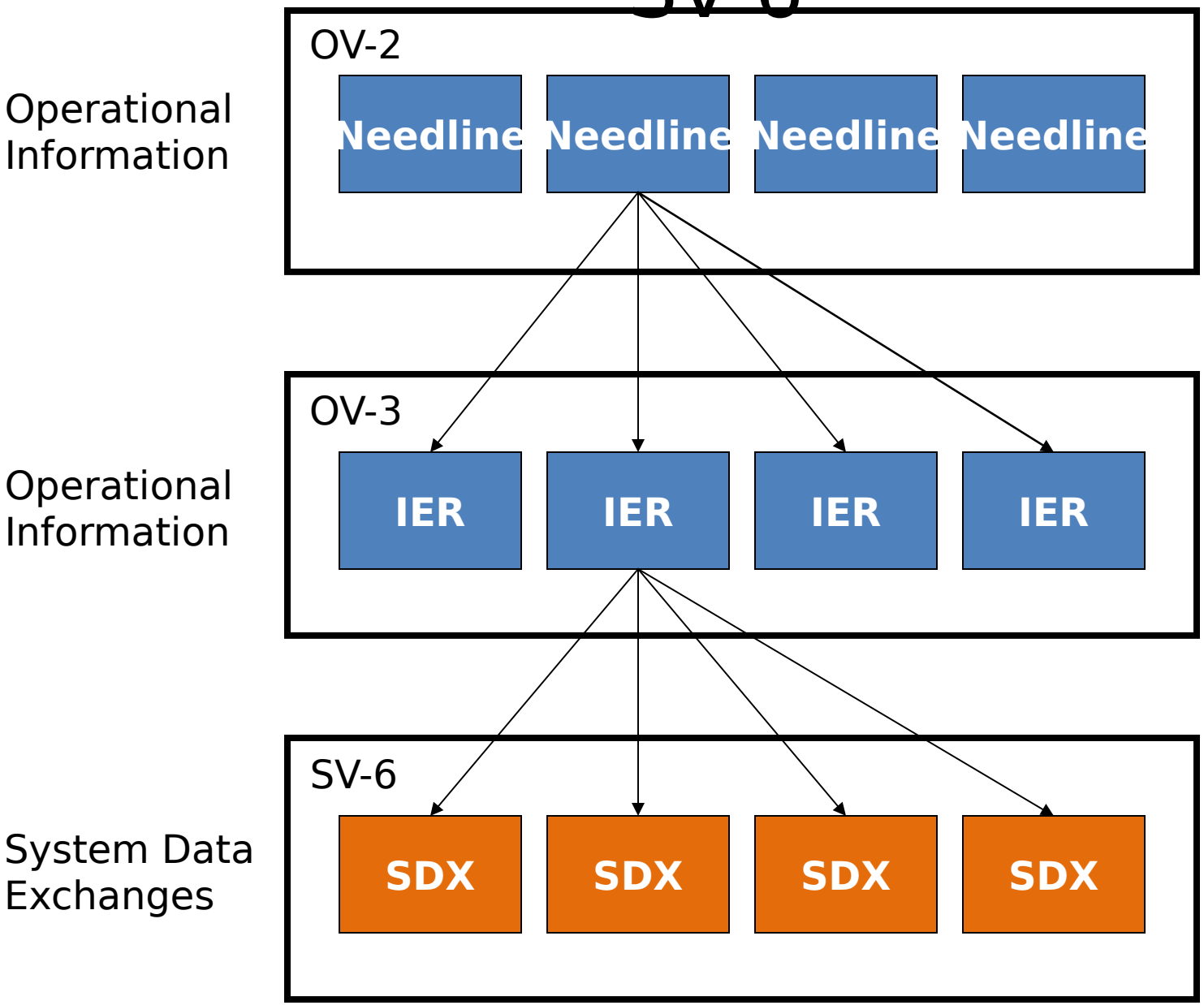
Documenting the Requirements



Documenting Derived System Technical Requirements

- Comply with the Net-Centric Data Strategy, Net-Centric Services Strategy, DoD Information Enterprise Architecture (where applicable)
  - System functions in the SV-4a
  - System data exchanges in the SV-6
  - Data elements in the SV-11
- Comply with Global Information Grid (GIG) Enterprise Service Profiles (GESPs)
  - Logical interfaces in the SV-1
  - Physical interfaces in the SV-2
  - Standards in the TV-1
- Comply with IA requirements, specify IA controls
  - Logical interfaces in the SV-1
  - Physical interface in the SV-2
  - System functions in the SV-4a
  - System data exchange in the SV-6
- Comply with spectrum and supportability requirements to include Selective Availability Anti-Spoofing Module (SAASM), Spectrum, and Joint Tactical Radio System (JTRS) requirements
  - Each physical interface in the SV-2 or system function in the SV-4a that uses the electromagnetic spectrum

Relationship Between OV-2, OV-3, SV-6



Outline

- Overview
- Background
- Interoperability Requirements
- JCAS Examples
  - Link-16
  - Chat
- Summary

Summary

- Achieving interoperability within the DoD requires more than building DoDAF architecture products for the NR-KPP. Interoperability has inherent operational and system technical requirements that must be met in order to provide the desired warfighting capability.
- Interoperability has 4 inherent requirements that are independent of DoD instructions
  1. Support Military Operations
  2. Enter and Be Managed In The Network
  3. Exchange Information
  4. Satisfy Technical Requirements
- Systems Engineering principles can be used to address these requirements
  - NR-KPP Manual describes the way to do this

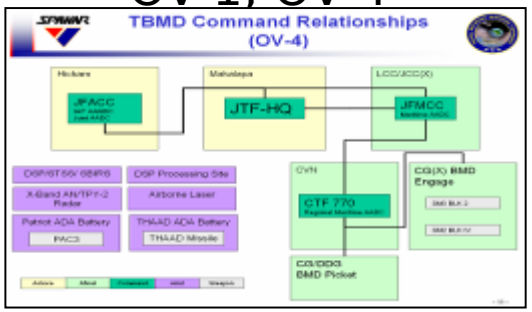
Backup

Definitions – Missions

- Mission
  - The task, together with the purpose, that clearly indicates the action to be taken and the reason therefore. In common usage, especially when applied to lower military units, a duty assigned to an individual or unit. (JP 1-02)
  - Definition fits mission areas, mission threads, kill chains, and their component activities.
- Mission Area
  - A specific military functions
  - For example: AAW, ASW, BMD…
- Mission Thread
  - Specific, end-to-end instantiation of a mission area
  - Includes time sequenced operational activities
  - Can build an OV-6c based on this description
  - For example: The ASW mission area can have SSN vs. SSN, Ship vs. SSN, and Air vs. SSN mission threads
- Kill Chain
  - Slice/portion/subset of a tactical mission thread
  - Includes specifics such as targets, sensors, weapons, and weather
  - For example: SSN vs. SSN mission thread will have a kill chain that describes the activities directly related to the SSN firing a specified torpedo at a specific enemy submarine

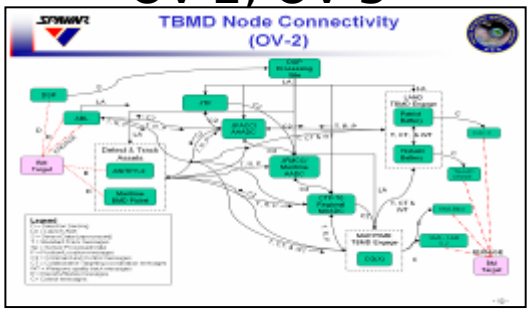
Architectures To Document Mission Threads
DoDAF Operational Views (OV)

OV-1, OV-4



Who are the players

OV-2, OV-3



What information do they exchange (Operational IERs)

OV-6c, OV-5

What they do with the information

Bin the information each player needs into 3 categories based on how they use the data:

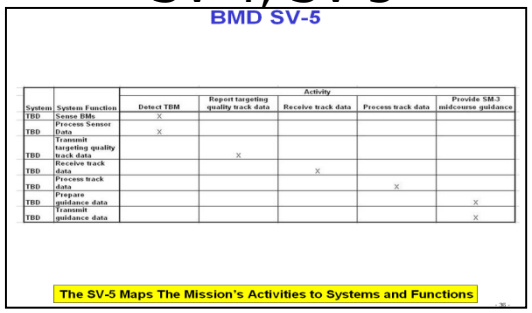
- View the data
- Publish the data
- Process the data

Categories determine the services, applications, and hardware required at each player

Architectures to Describe Mission Threads

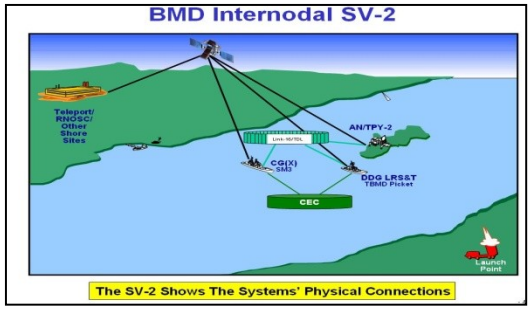
DoDAF System Views (SV)

SV-4, SV-5



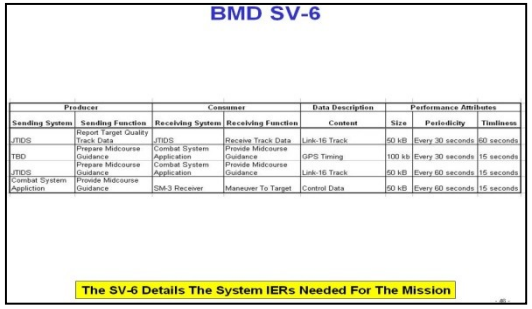
What system functions support the mission thread

SV-1, SV-2



How are the systems connected

SV-6, SV-7



How well do the systems perform

Document the available systems and characterize them in terms of:

- Relation to mission
- Connections
- Performance

Information can be used to inform systems engineering activities, build a system spec, or to document the capabilities of an existing system

References

- NR-KPP Manual
  - https://www.intelink.gov/wiki/Net_Ready_Key_Performance_Parameter_(NR_KPP)_Manual
- OSD SoS SE Guide
  - https://acc.dau.mil/adl/en-US/147494/file/44325/SE-Guide-for-SoS.pdf